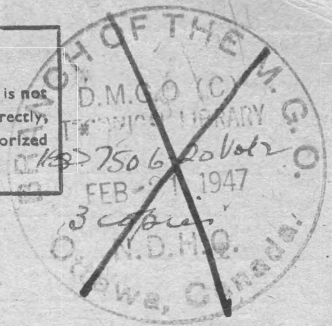


MANUAL

1981  
1981  
1981  
Cancelled

26  
Manuals  
3603

**RESTRICTED**  
The information given in this document is not to be communicated, either directly or indirectly, to the Press or to any person not authorized to receive it.



**MAINTENANCE MANUAL**  
**FOR THE**  
**ORDNANCE, Q.F. 40-MM., MARKS 1\* & 1/2**  
**ON**  
**MOUNTINGS, 40-MM. A.A., MARKS 1, 1A,**  
**1B, 3, 3/1, 3/2, 3/3 and 4**  
**AND**  
**PLATFORMS, 40-MM. A.A. MOUNTINGS,**  
**MARKS 1, 1A, 2, 3 and 4**  
**INCLUDING**  
**MOUNTINGS, 40-MM. A.A. :—**  
**MARK 5 S.P. (MORRIS CARRIER)**  
**MARKS 7 AND 8 (TWO-WHEELED PLATFORM,**  
**MARK 1/L FOR INDIA)**  
**MARKS 9 AND 10 (TWO-WHEELED PLATFORM,**  
**MARK 1; BANTAM EQUIPMENT)**

**LAND SERVICE**

**1946**

By Command of the Army Council,

*Eric B. B. Ford.*

REF  
TECH  
CF  
155  
G7  
M311  
1946  
c.1

*called  
issue  
6/7 dated  
2/5/60*

**THE WAR OFFICE,**  
**15th October, 1946.**

## AMENDMENTS

[illegible]



## CONTENTS

	SECTION	PAGE
Ordnance, Q.F. 40-mm., Marks I* and 1/2 .. .. .	1	5
Mountings, 40-mm. A.A., Marks 1, 1A, 1B, 3, 3/1, 3/2, 3/3 and 4 and Platforms, Marks 1, 1A, 2, 3 and 4 .. .. .	2	26
General instructions on Maintenance and Task tables .. .. .	3	52
Lubrication .. .. .	4	56
Stripping and assembling .. .. .	5	63
Detailed tasks, tests and adjustments .. .. .	6	78
Ammunition .. .. .	7	89
Miscellaneous data .. .. .	8	101

## APPENDICES

	NUMBER	PAGE
Ordnance, Q.F. 40-mm., Mark 1* on Mountings, 40-mm. A.A., Marks 5 and 5/1, and Platform carrier, Morris, 40-mm. A.A., Mark 1 .. .. .	1	103
Ordnance, Q.F. 40-mm., Mark 1* on Mountings, 40-mm. A.A., Marks 7 and 8, and Platform firing 40-mm. A.A. Mounting, Mark 1/L/India .. .. .	2	104
Ordnance, Q.F. 40-mm., Mark 1/2 on Mountings, 40-mm. A.A., Marks 9 and 10, and Platform, 2-wheeled, 40-mm. A.A., Mark 1 .. .. .	3	105

## INDEX

	PARA.		PARA.
<b>A</b>		Body .. .. .	36
Ammunition—		Bore—cleaning of .. .. .	66
Care and preservation of .. .. .	122-129	Brake gear—Lockheed type—	
Description of .. .. .	103-113	Description of .. .. .	24
Labels on boxes .. .. .	121	Care and adjustment of .. .. .	95
List of packages .. .. .	114	Breech casing .. .. .	4
Markings on .. .. .	115-120	Breech fittings—care of .. .. .	62
Assembling of equipment .. .. .	80	Breech mechanism .. .. .	5
Automatic Loader "A"—		Action of .. .. .	6
Action of and firing arrangements .. .. .	10	Breech ring .. .. .	3
Description of .. .. .	9	Buffer—	
Differences from other types .. .. .	8	Correct liquid and colour code .. .. .	70
Axletree, special—		To empty .. .. .	84
No. 222 .. .. .	17	To fill .. .. .	83
No. 223 .. .. .	18	To replenish .. .. .	85
No. 229 .. .. .	30	To tighten glands .. .. .	86
No. 230 .. .. .	30		
No. 387 .. .. .	31	<b>C</b>	
No. 388 .. .. .	31	Care and preservation of ammuni-	
		tion .. .. .	122-129
<b>B</b>		Care and maintenance of equipment .. .. .	60-70
Ball bearings and racers—care of .. .. .	88	Cartridge deflector and chute .. .. .	42
Balancing gear—		Cease fire stop .. .. .	55
Front axle .. .. .	22	Clinometer plane—cleaning of .. .. .	65
Gun .. .. .	43	Connector, engine draught—	
Adjustment of .. .. .	90	No. 30—description of .. .. .	20
Rear axle .. .. .	23	Differences between Nos. 39 and 30 .. .. .	30
Barrel .. .. .	2	Differences between Nos. 39 and 41 .. .. .	31
Care and maintenance of .. .. .	63	Control of run-out .. .. .	72
Flaws or cracks .. .. .	64	Correct liquid for buffers .. .. .	70
To remove and replace .. .. .	79	Crating and uncrating of equipment—	
Base ring .. .. .	34	Instructions for .. .. .	99-102

	PARA.
<b>D</b>	
Data, miscellaneous .. ..	130
Detailed tasks, tests and adjustments .. ..	81-87
Dismantling of equipment .. ..	79
Drums, indicator bearing and range .. ..	59
Drum, range check bubble .. ..	11

<b>E</b>	
Electric installation .. ..	44
Elevating gear .. ..	45
Care of .. ..	91
Elevating switch trip gear—care of .. ..	92
Engine draught connector, No. 30 .. ..	20

<b>F</b>	
Firing gear .. ..	48
Care of .. ..	94
Flaws and cracks in barrel .. ..	64
Foot rests .. ..	40
Front axle balancing gear .. ..	22
Frost—protection against .. ..	69
Fuzes, Percussion .. ..	111-113

<b>G</b>	
Gauging protrusion of striker .. ..	81
Gear—	
Elevating .. ..	45
Care of .. ..	91
Firing .. ..	48
Traversing .. ..	46
Care of .. ..	91
Traversing power synchronizing .. ..	49
Glands—tightening of .. ..	86
Gun balancing gear .. ..	43
Adjustment of .. ..	90
Gun stay .. ..	21
Guns to be covered when not in use .. ..	68

<b>H</b>	
Hydraulic brake gear—	
Care and adjustment .. ..	95
Hydraulic buffer—	
To empty .. ..	84
To fill .. ..	83
To replenish .. ..	85
To tighten the glands .. ..	86

<b>I</b>	
Instructions for—	
Crating and uncrating of equipment .. ..	99-102
Lubrication .. ..	76 and 77
Maintenance of equipment .. ..	60-70
Tests and adjustment of sights .. ..	97

<b>J</b>	
Jacks, levelling screw .. ..	16

<b>L</b>	
Labels on ammunition boxes .. ..	121
Layers' seats .. ..	39
Leakage—precaution against .. ..	74
Levelling screw jacks .. ..	16
Light preservation of equipment .. ..	61
List of Mountings showing old and new Marks .. ..	56
Loading platform .. ..	38
Lower ball racer .. ..	35
Low speed direction indicator .. ..	47
Lubricators and lubrication charts .. ..	76
Lubricants—table of .. ..	77

<b>M</b>	
Maintenance records .. ..	60
Marks of mountings—list of .. ..	56
Markings on ammunition .. ..	115-120
Mountings .. ..	12
Mark 1—differences from Mark 3 .. ..	50
Mark 1A—differences from Mark 1 .. ..	51
Mark 1B—differences from Mark 1 .. ..	52
Mark 3/1—differences from Marks 3 and 3A .. ..	53
Mark 3/2—differences from Marks 3 and 4 .. ..	54
Mark 4—differences from Mark 3/1 .. ..	55
Miscellaneous data .. ..	130

<b>O</b>	
Ordnance, Q.F. 40-mm, Mark 1*—	
Barrel .. ..	2
Breech ring .. ..	3
Breech casing .. ..	4
Breech mechanism .. ..	5
Action of .. ..	6

<b>P</b>	
Packings—care of .. ..	73
Platforms—	
Mark 1—description of .. ..	13
Marks 1A and 2—differences from Mark 1 .. ..	29
Mark 3—differences from Marks 1 and 2 .. ..	31
Mark 4—differences from Mark 3 .. ..	32
Platform, loading .. ..	38
Power traversing synchronizing gear—care of .. ..	93
Protection against frost .. ..	69
Protrusion of striker—gauging of .. ..	81
Projectiles .. ..	110
Primers—description and action of 105-108 .. ..	

<b>R</b>	
Range drum check bubble .. ..	11
Rear axle balancing gear .. ..	23
Receiver gear—care of .. ..	91
Recuperator—to replace a spring .. ..	87
Recoil system—	
Action of .. ..	7
Care of .. ..	71
Faults—causes and remedies .. ..	98
Recoil—normal working length .. ..	72
Run-out—control of .. ..	71

Shield  
Sights  
Man  
A  
Mar  
Soda-  
Spirit  
Steerin  
Stopp  
Strike  
Stripp  
Gen  
Inst  
Suppo  
Swivel

Task t  
Traver

EQUIP  
Or

Mo

Mo

Mo

Mo

(SO

	PARA.		PARA.
<b>S</b>			
Shields .. .. .	41	Traversing power synchronizing gear	
Sights, correctional—		—care of .. .. .	93
Mark 5/1—		Trunnion bearings—care of .. .. .	89
Description of .. .. .	57	Tyres—pressures and sizes .. .. .	130
Action of .. .. .	58		
Mark 5—tests and adjustment .. .. .	97	<b>U</b>	
Soda—use of forbidden .. .. .	67	Uncrating of equipment .. .. .	102
Spirit level bubbles .. .. .	15		
Steering gear .. .. .	19	<b>W</b>	
Stoppages—causes and remedies .. .. .	82	Wheels, pneumatic—	
Striker—gauging protrusion of .. .. .	81	No. 10 .. .. .	25
Stripping an assembling—		No. 11 .. .. .	26
General remarks .. .. .	78	No. 21 .. .. .	27
Instructions for .. .. .	79	No. 22 .. .. .	28
Supporting frame .. .. .	37	No. 73 .. .. .	30
Swivelling head .. .. .	14	No. 75 .. .. .	30
<b>T</b>			
Task tables .. .. .	75		
Traversing gear—care of .. .. .	91		

## LIST OF INSTRUCTIONAL WALL DIAGRAMS

*Subject illustrated.*

Diagram  
Number.

## EQUIPMENT DIAGRAMS

Ordnance, Q.F. 40-mm., Marks 1\* and 1/2—

Buffer .. .. .	E. 506
Diagrammatic arrangement of "A" automatic loader and firing arrangement .. .. .	E. 772

### Mounting, 40-mm. A.A., Mark 1—

Sights	..	..	..	..	..	..	..	E. 497
Firing position (right side elevation)	..	..	..	..	..	..	..	E. 498
Hub, wheel and brake elements	..	..	..	..	..	..	..	E. 499
Front axle balancing gear	..	..	..	..	..	..	..	E. 500
Elevating gear	..	..	..	..	..	..	..	E. 501
Front axle, hub and wheels	..	..	..	..	..	..	..	E. 502
Rear axle, hub and wheels	..	..	..	..	..	..	..	E. 503
Traversing gear	..	..	..	..	..	..	..	E. 504
Firing position (left side elevation)	..	..	..	..	..	..	..	E. 505
Gun, balancing gear	..	..	..	..	..	..	..	E. 507
Firing position (sectional arrangement)	..	..	..	..	..	..	..	E. 512
Lubrication chart	..	..	..	..	..	..	..	E. 514
Rear axle balancing gear	..	..	..	..	..	..	..	E. 515

### Mounting, 40-mm. A.A., Mark 3—

Side elevation	..	..	..	..	..	..	E. 917
Frame, platform, seats, footrests, etc.	..	..	..	..	..	..	E. 920
Firing gear	..	..	..	..	..	..	E. 923
Elevation trip switch gear	..	..	..	..	..	..	E. 928
Traversing power synchronizing gear	..	..	..	..	..	..	E. 929
Traversing gear	..	..	..	..	..	..	E. 934
Lubrication chart	..	..	..	..	..	..	E. 1094

### Mountings, 40-mm. A.A., Marks 3 and 3/2—

[illegible]

**Mountings, 40-mm. A.A., Marks 3/1 and 4—**

Elevating gear	..	..	..	..	..	..	..	E. 1081
Traversing gear	..	..	..	..	..	..	..	E. 1083

(SO 1708)

A 2



<i>Subject illustrated.</i>	<i>Diagram Number.</i>
<b>Mountings, 40-mm. A.A., Marks 3/2 and 4—</b>	
Firing gear .. .. .	E. 1093
<b>Mounting, 40-mm. A.A., Mark 4—</b>	
Lubrication chart .. .. .	E. 1095
Traversing power synchronizing gear .. .. .	E. 1092
<b>Platforms, 40-mm. A.A. Mountings—</b>	
Mark 2 .. .. .	E. 933
<b>Sights—</b>	
40-mm. A.A. Mounting, Mark 1 .. .. .	E. 919
40-mm. A.A. Mounting, Mark 3 .. .. .	E. 1080
<b>Sights, Correctional, 40-mm. A.A. Mountings—</b>	
Mark 4 .. .. .	E. 1107
Demands for the above Equipment diagrams will be submitted to the Commandant, Central Ordnance Depot, Donnington, near Wellington, Salop, on a scale of one set per battery.	
<b>AMMUNITION DIAGRAMS</b>	
Projectile (Filling) .. .. .	E. 859 (Sheet 1)
Projectiles (Markings) .. .. .	E. 859 (Sheet 2)
Fuze, percussion—	
No. 251, Mark 1 .. .. .	E. 815
No. 255, Mark 1 .. .. .	E. 1348
Primer, percussion, Q.F. cartridges, No. 18, Marks 1 and 2 .. .. .	E. 509
Tracer and igniter, shell—	
No. 11, Marks 3, 3A and 3B .. .. .	E. 1401
No. 14, Mark 3 .. .. .	E. 1414
Demands for the above Ammunition diagrams will be submitted to the Commandant, Central Ammunition Depot, Bramley, Hants, on a scale of one set per Battery.	

NOTE.—The text and illustrations in this Maintenance Manual are correct up to October, 1946; subsequent modifications and amplifications will be covered by amendments as required. Any alterations that may be suggested should be forwarded to the Inspector-General of Armaments.

Through  
denote the  
referred to  
noted, how  
available,  
defects th  
and keep

1. The  
frame.

2. The  
at its rea  
breach rin  
supports a  
screw-thre  
to keep t  
threaded  
the barrel  
registered

3. The  
threads to  
prepared f  
it is raised

The br  
ment of v  
ment, bree

4. The  
parts are  
box-shaped  
supports t  
for the rec  
ring. The  
loading me  
the mechan

In orde  
Mark 5, a  
fracture.

Existin  
weights in

5. The  
side of the  
splined for  
cranks and  
spring cove  
the spring.  
or by hand

## SECTION I

## ORDNANCE, Q.F. 40-MM., MARKS 1\* AND 1/2

## FOREWORD

Throughout this publication various paragraphs and tasks marked thus † denote that, in normal circumstances, the adjustment or other operation referred to therein will only be carried out by an artificer. It should be noted, however, that in a case of extreme emergency, when no artificer is available, any competent person present should do his utmost to remedy any defects that occur if, by so doing, he can render the equipment serviceable and keep it in action.

1. The gun consists principally of a barrel, breech ring and breech casing frame.

2. The **barrel** (Fig. 1) is a monobloc of forged steel, prepared externally at its rear end with interrupted threads to facilitate rapid assembly in the breech ring. In front of the threads a shoulder is formed, the front of which supports a washer which bears against a recuperator spring. The barrel is screw-threaded to receive a collar which bears against a sleeve of the recuperator to keep the spring in compression. The front end of the barrel is screw-threaded to take the flame guard. The usual markings are stamped upon the barrel on its upper side; the guard and collar are also stamped with the registered barrel number on the upper side.

3. The **breech ring** is prepared internally at the front with interrupted threads to receive those of the barrel. Towards the rear, inclined grooves are prepared for the breech block, the incline carrying the block to the front as it is raised. The rear part is shaped to form a loading trough.

The breech ring is also generally prepared for the reception and attachment of various parts, the barrel catch, control arm, breech ring stop, abutment, breech block stops and safety plunger.

4. The **breech casing** (Fig. 2), comprises a frame to which non-recoiling parts are attached or accommodated in. It has a cylindrical front and a box-shaped rear. The cylindrical part surrounds the recuperator spring and supports the barrel and has a shoulder formed internally to form a seating for the recuperator spring washer when the barrel is assembled in the breech ring. The box-shaped portion encloses the breech ring, breech mechanism, loading mechanism, etc., various apertures, closed by covers, permit access to the mechanism.

In order to reduce the elevating effort when using the Sight Correctional, Mark 5, a new breech casing rear cover has been designed for future manufacture.

Existing breech casing rear covers are fitted with lead counterbalance weights in order to counteract the preponderance and reduce elevating effort.

5. The **breech mechanism** (Fig. 3), is of the vertical wedge type, the upper side of the block being shaped to form a loading trough. The crank shaft is splined for the greater part of its length from the left end to receive the inner cranks and the outer crank. The right end is splined to receive the closing spring cover and has a longitudinal keyway cut to receive the inner end of the spring. The mechanism is designed to be operated either automatically or by hand.

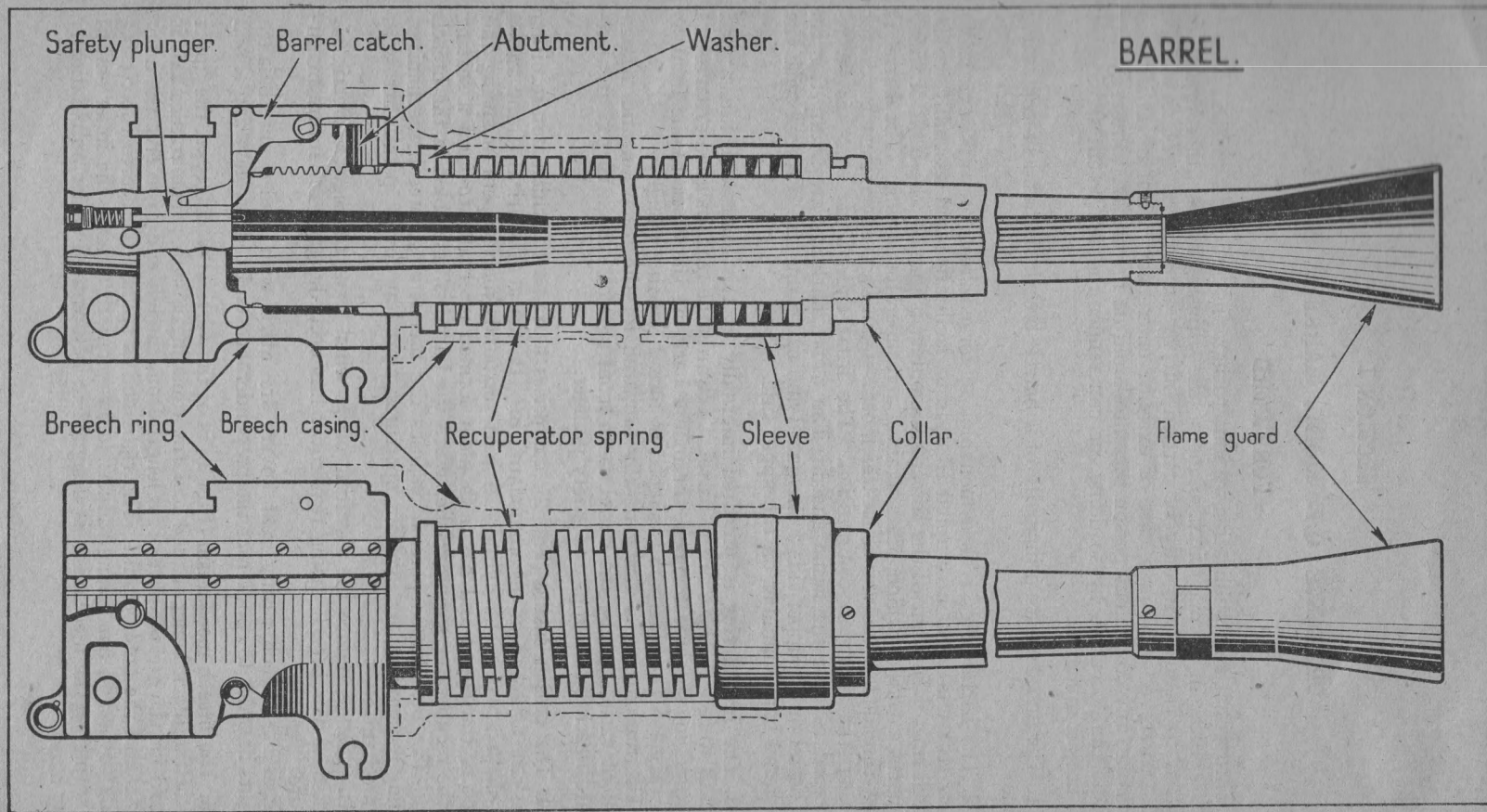
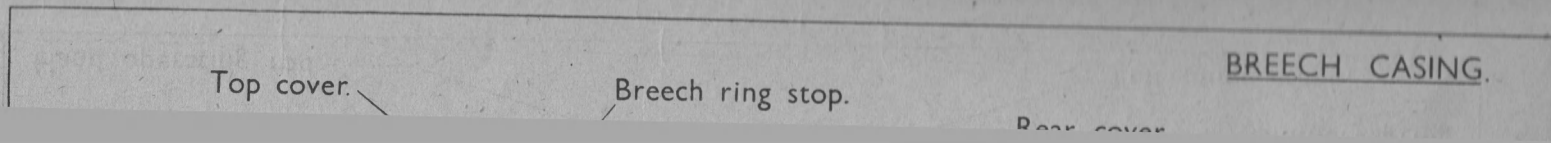


FIG. 1.





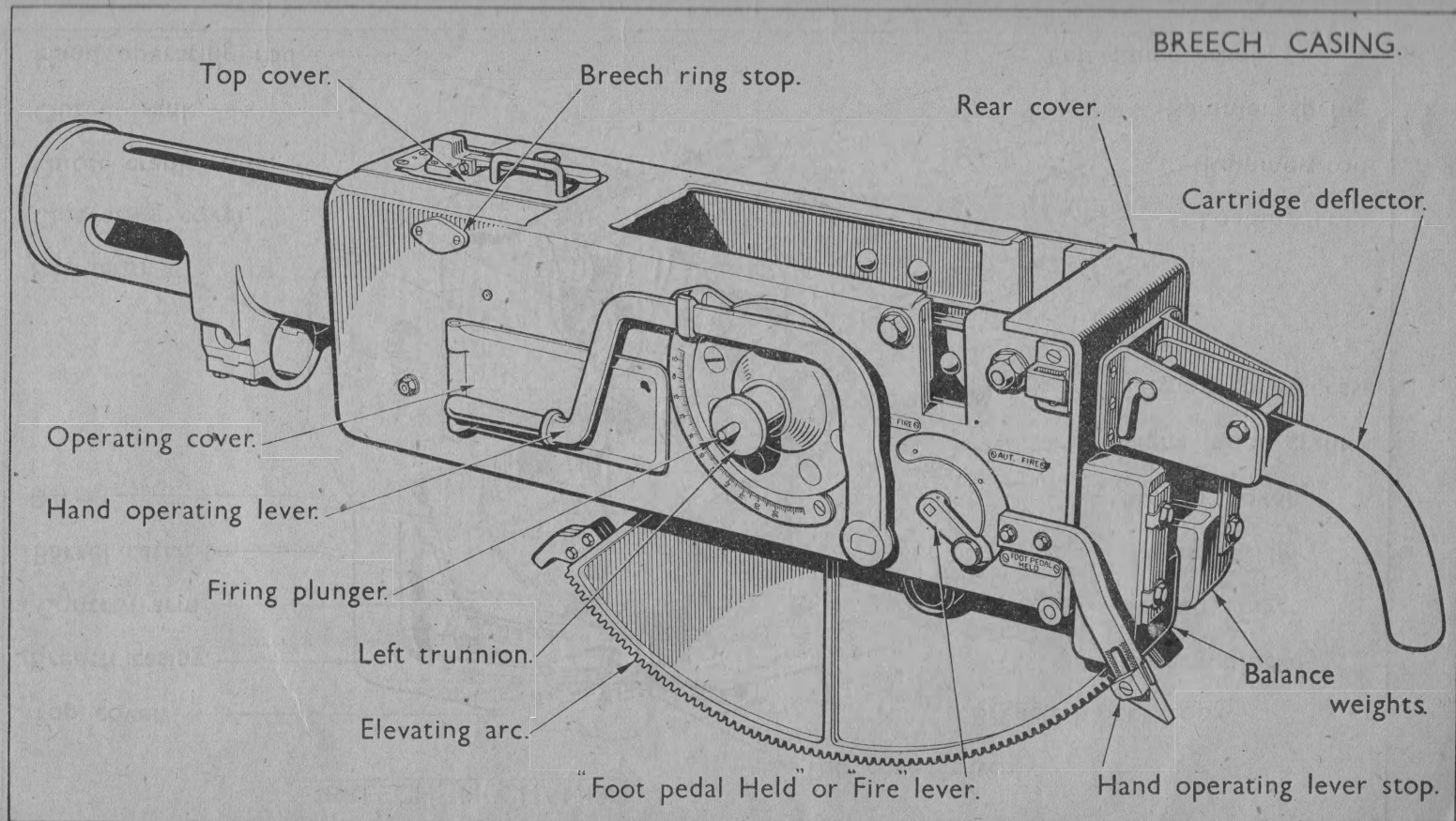


FIG. 2.

# BREECH MECHANISM.

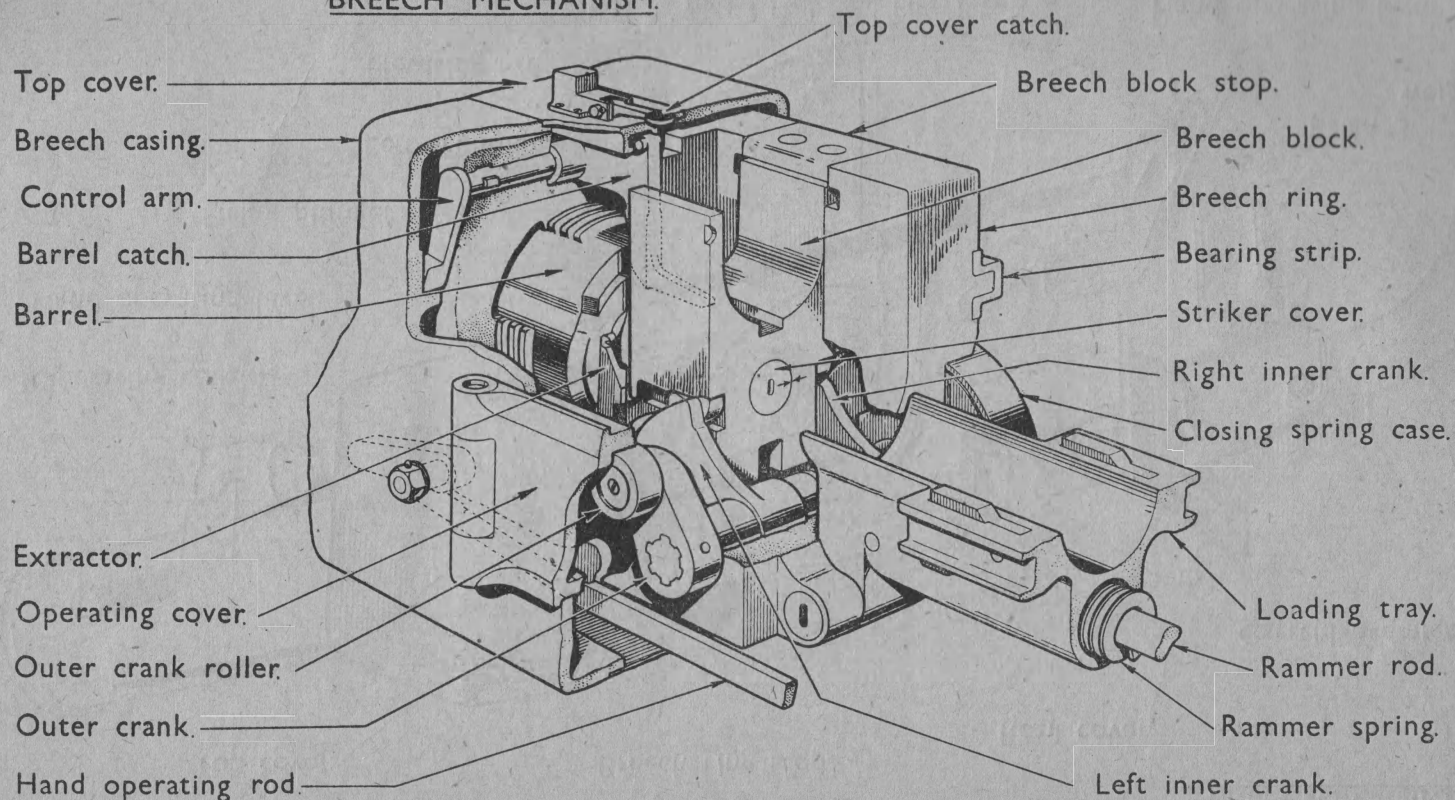


FIG. 3.

**6. Action of the breech mechanism** (Fig. 4).—The recoil of the gun, in addition to operating the breech mechanism, also operates an automatic loader.

(a) **To close the breech.**—The breech is retained in the open position by the extractors, the closing spring is under tension and the striker is held in the cocked position by the inner cocking lever which is prevented from rotating by the check plunger.

(i) **By hand.**—Pull the hand operating lever fully to the rear. Press the extractor outer releasing lever rearward and downward thereby rotating the inner releasing lever and extending its spring. The inner releasing lever engages and rotates the extractor spindle arm which rotates the extractor spindle and the extractors to the front. The rotation of the extractors causes their hook-shaped projections to be withdrawn from the upper ends of the ribs on the front face of the breech block. The breech block is now free to be raised by action of the closing spring, the movement being controlled by the hand operating lever. The closing spring reasserts itself and rotates its cover which, being splined to the crankshaft, rotates that also. The left and right inner cranks rotate with the shaft and the lugs, riding along the horizontal grooves in either side of the block, raise it to the closed position. After the block is raised, the lugs continue to move along the inclines at the rear of the horizontal grooves until they reach a position when they support the breech block, *i.e.*, the weight of the block cannot rotate the inner cranks.

During the rotation of the cranks, the left inner crank moves away from the outer cocking lever, which remains stationary, and its bevel is moved from the left end of the check plunger. The bevel projection on the right inner crank, on arrival at the closed position, engages the bevelled end of the check plunger and forces it to the left, compressing its spring and bringing the curved slot opposite the lower arm of the inner cocking lever. The check plunger is therefore moved from the cock notch in the inner cocking lever which is now free to rotate under action of the striker main spring. The outer crank is rotated by the crankshaft to the breech closed position.

The striker main spring, now released by the inner cocking lever and check plunger, carries the striker violently forward on to the cap of the cartridge and fires it.

The outer releasing lever is released immediately the breech block closes and the inner and outer releasing levers are returned to normal positions under the action of their springs.

(ii) **By automatic.**—The cartridge, on being loaded, engages the extractors and rotates them to the front thereby releasing the breech block. The closing spring reasserts itself and the action is the same now as for (i).



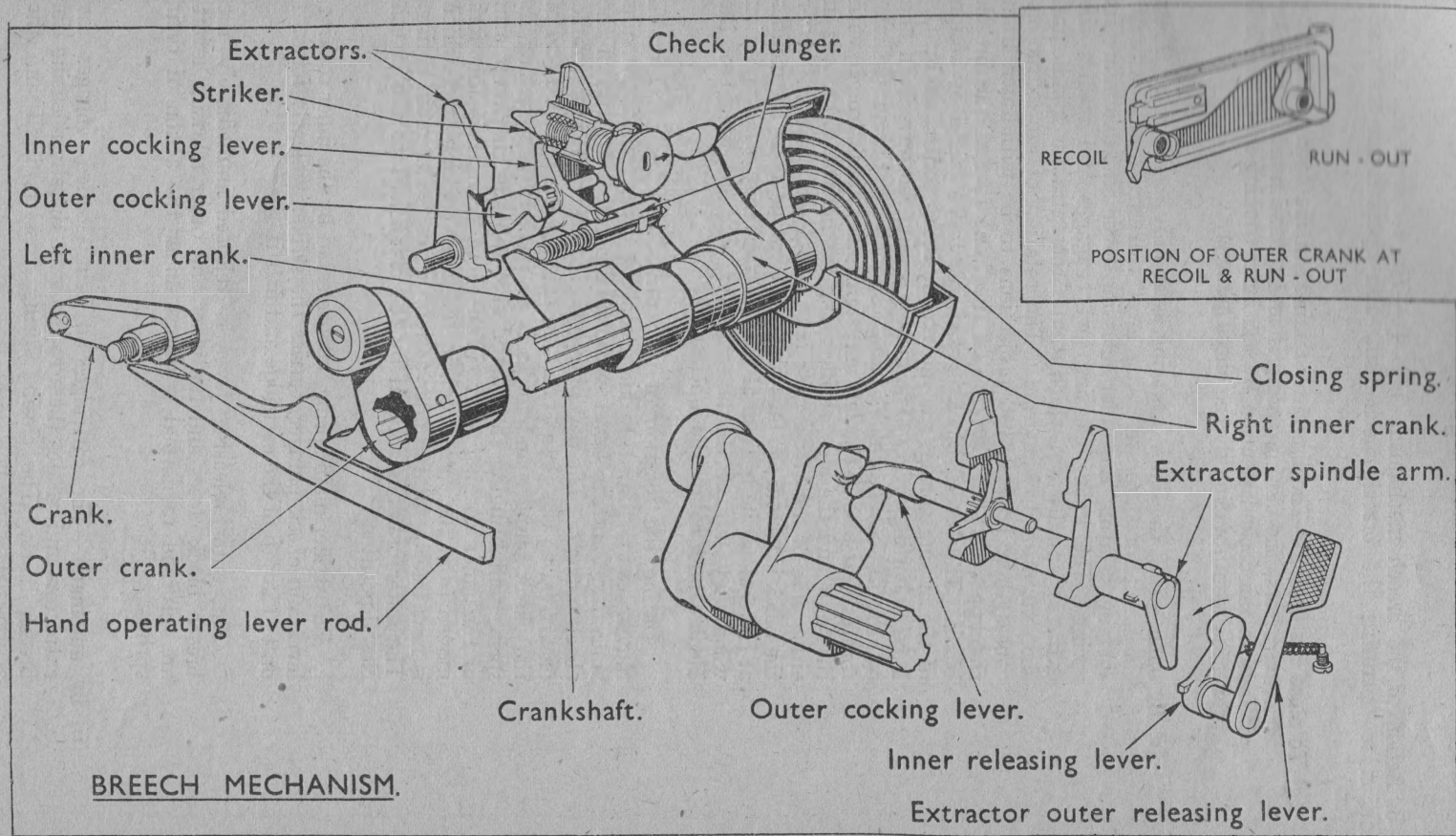


FIG. 4.

NOTE.—  
during auto

(2)

(b) Ta  
(2)

(b) **To open the breech.**

(i) **By hand** (Fig. 5).—The hand-operating lever is lifted from its housing in the front catch bracket and pulled to the rear as far as it will go. The lever rotates the hand-operating lever shaft which pulls the hand-operating lever rod downward and to the rear, through its guide bracket, the movement of the rod being controlled by the hand-operating lever rod crank which pivots in the breech casing. The projection on the hand-operating lever rod engages the lower arm on the outer crank and rotates the crank in an anti-clockwise direction. The outer crank rotates the crankshaft which rotates the right and left inner cranks and at the same time rotates the closing spring cover which places the spring under a little more tension.

During the initial rotation of the inner cranks the breech block is not moved, but the bearing surface on the left inner crank bears on the outer cocking lever which is rotated and with it the inner cocking lever which, bearing against the shoulder on the striker, withdraws the striker to the rear, compressing its spring. At the same time, the right inner crank bevel leaves the bevel on the check plunger which is held by the lower arm of the inner cocking lever engaging the curved slot in the plunger.

Further rotation of the inner cranks brings their lugs into the horizontal grooves of the breech block which is forced down into the fully open position and the closing spring cover rotates and places the spring under greater tension. As the breech block descends the flanges on the ribs engage the toes on the extractors which are rotated to the rear, and the cartridge case, if loaded, is ejected. At the same time, the left inner crank forces down the outer cocking lever which further rotates the inner cocking lever until the cock notch on the latter is clear of the curved recess in the check plunger. The check plunger is now forced to the right under action of its spring, assisted if necessary by the bevel on the left inner crank engaging the left end of the plunger to engage the cock notch and retain the inner lever, and with it the striker, in the cocked position. When the pressure on the hand-operating lever is released, and the lever folded forward, the closing spring tends to reassert itself and thereby rotates the crankshaft and inner cranks, which raise the breech block until the upper ends of the ribs are engaged by the hook-shaped projections on the extractors, these retaining the breech block in the loading position.

The rotation of the hand-operating lever shaft rotates the arm on its inner end. The arm operates the rammer cocking levers.

(ii) **By automatic.**—When the gun recoils on firing, the roller on the outer crank runs along the cam formed in the operating cover in the left side of the breech casing. The cam rotates the outer crank and the action is the same as for (i) except that the extractors hook on the ribs of the breech block as the gun runs out instead of when the hand-operating lever is folded forward.

NOTE.—The hand-operating lever is housed in the front catch bracket during automatic loading and firing.

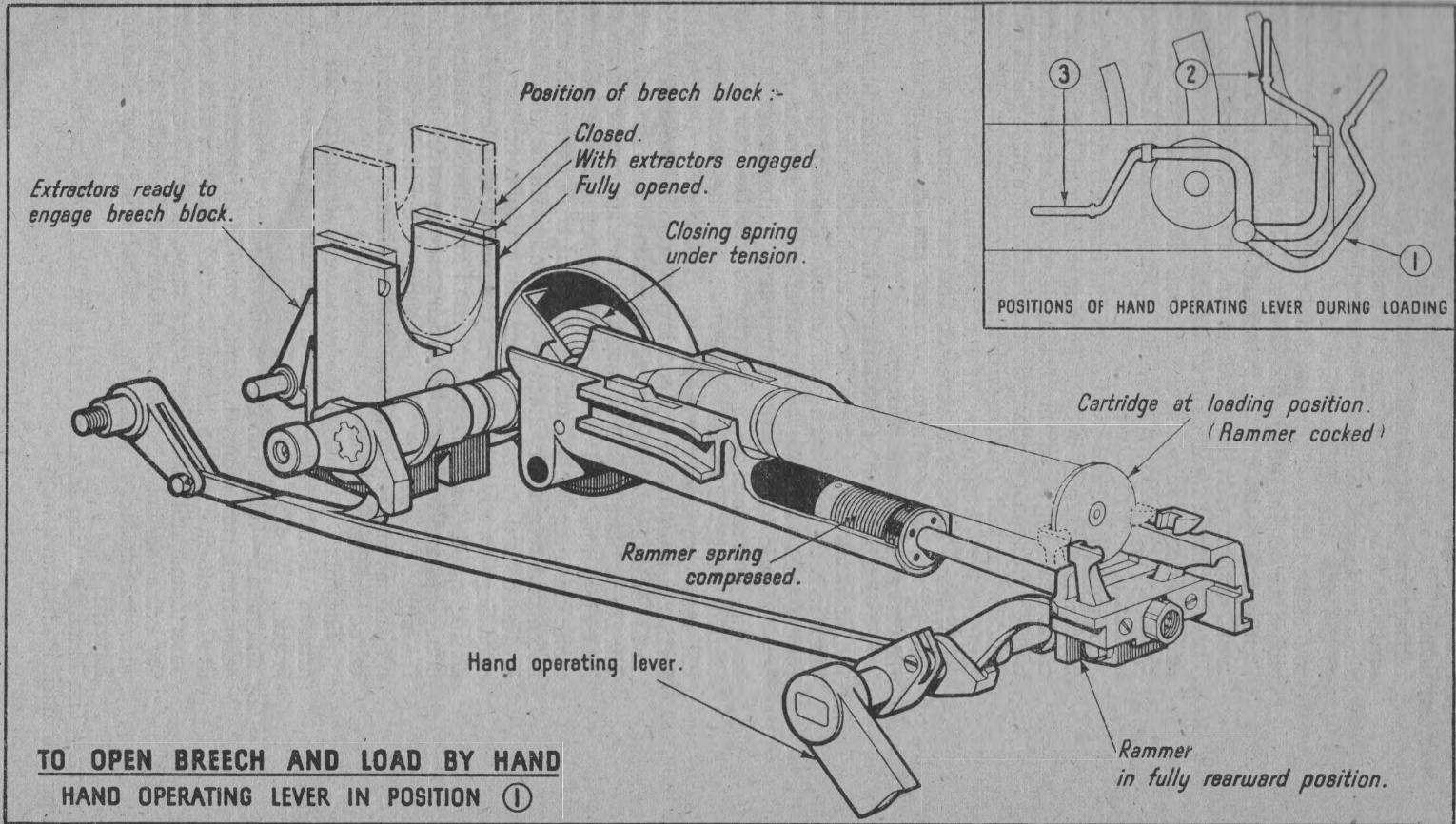


FIG. 5.

7. Recoil  
 regulate recoil  
 position and  
 The buffer  
 rod bush, cor  
 valve and va  
 The pisto  
 whilst the b  
 Action (F  
 buffer cylin  
 to the front  
 the piston r  
 the tapered c  
 up a fluid r  
 liquid also fo  
 ports in the  
 seat in the c  
 Liquid al  
 (a) The  
 (b) The  
 (c) Thro  
 at  
 On recoil  
 front and ma  
 (Fig. 1) being  
 During run-c  
 Liquid in the  
 ports in the  
 the liquid in  
 of the valve  
 through the  
 through the  
 reduce the fl  
 of liquid is n  
 the run-out a  
 rod to the fr  
 to the buffer  
 circular reces  
 the rear of th  
 that in the  
 throttling bu  
 flow space as  
 speed and pre  
 The recoil  
 NOTE.—T  
 by the buffer.  
 8. The Ma  
 all types of e  
 patterns.  
 The "M"  
 loaders, differe  
 and "C" loa  
 patterns.



**7. Recoil system.**—The **recoil system** comprises a hydraulic buffer to regulate recoil and a spring recuperator to return the barrel to the run-out position and retain it there.

The **buffer** (Fig. 6), consists principally of a cylinder, piston rod, piston rod bush, control rod, valve seat, valve, valve spring and nut, run-out adjusting valve and various packings.

The piston rod is secured to the lugs on the under side of the breech ring, whilst the buffer cylinder is secured to the under side of the breech casing.

**Action** (Fig. 7).—During recoil, the piston rod is drawn to the rear of the buffer cylinder over the control rod, thereby forcing the liquid from the rear to the front of the piston through the eight ports in the piston and through the piston rod throttling bush when the effective flow space is regulated by the tapered control rod, thereby controlling pressure in the cylinder and setting up a fluid resistance which absorbs and checks recoil. The pressure of the liquid also forces the non-return valve off its seating, thereby opening the four ports in the valve seat through which liquid passes to the rear of the valve seat in the control chamber.

Liquid also passes to the rear of the valve seat by:—

- (a) The two tapered grooves in the piston rod and over the valve seat.
- (b) The four ports in the control rod over the run-out adjusting valve and through the longitudinal boring in the valve seat.
- (c) Through the diametrical hole and longitudinal boring in the valve seat.

On recoil ceasing, the non-return valve spring returns its valve to the front and masks the four ports in the valve seating. The recuperator spring (Fig. 1) being highly compressed now returns the barrel to the run-out position. During run-out, the piston rod moves over the control rod to the front. Liquid in front of the piston passes through the piston rod bush and eight ports in the piston, back to the buffer cylinder. The control rod displaces the liquid in the control chamber, the liquid being forced from rear to front of the valve seat through the two tapered grooves in the piston rod, also through the longitudinal boring, over the run-out adjusting valve and out through the four ports in the control rod. The tapered grooves gradually reduce the flow space until no liquid can pass over the valve seat; the flow of liquid is now restricted to the longitudinal boring in the valve seat, over the run-out adjusting valve and through the four radial ports in the control rod to the front of the valve seat and thence by the eight ports in the piston to the buffer cylinder. Finally, the front end of the piston rod enters the circular recess in the plug of the control rod. Liquid between the piston and the rear of the plug is forced between the piston and plug into the recess and that in the recess is displaced through the space between the piston rod throttling bush and the control rod. The front taper of the rod reduces the flow space as the barrel approaches the run-out position, thereby reducing the speed and preventing a violent run out.

The recoil cycle is shown on Fig. 8.

**NOTE.**—The breech ring buffer pad absorbs any shock not counteracted by the buffer.

**8. The Mark I\* gun** is fitted with a breech casing arranged to accommodate all types of existing automatic loaders, *i.e.*, "A," "B," "C," "M," or "M\*" patterns.

The "M" and "M\*" loaders are generally similar to the "B" and "C" loaders, differing only in minor details to improve functioning. All "B" and "C" loaders will be converted in due course to the "M" and "M\*" patterns.

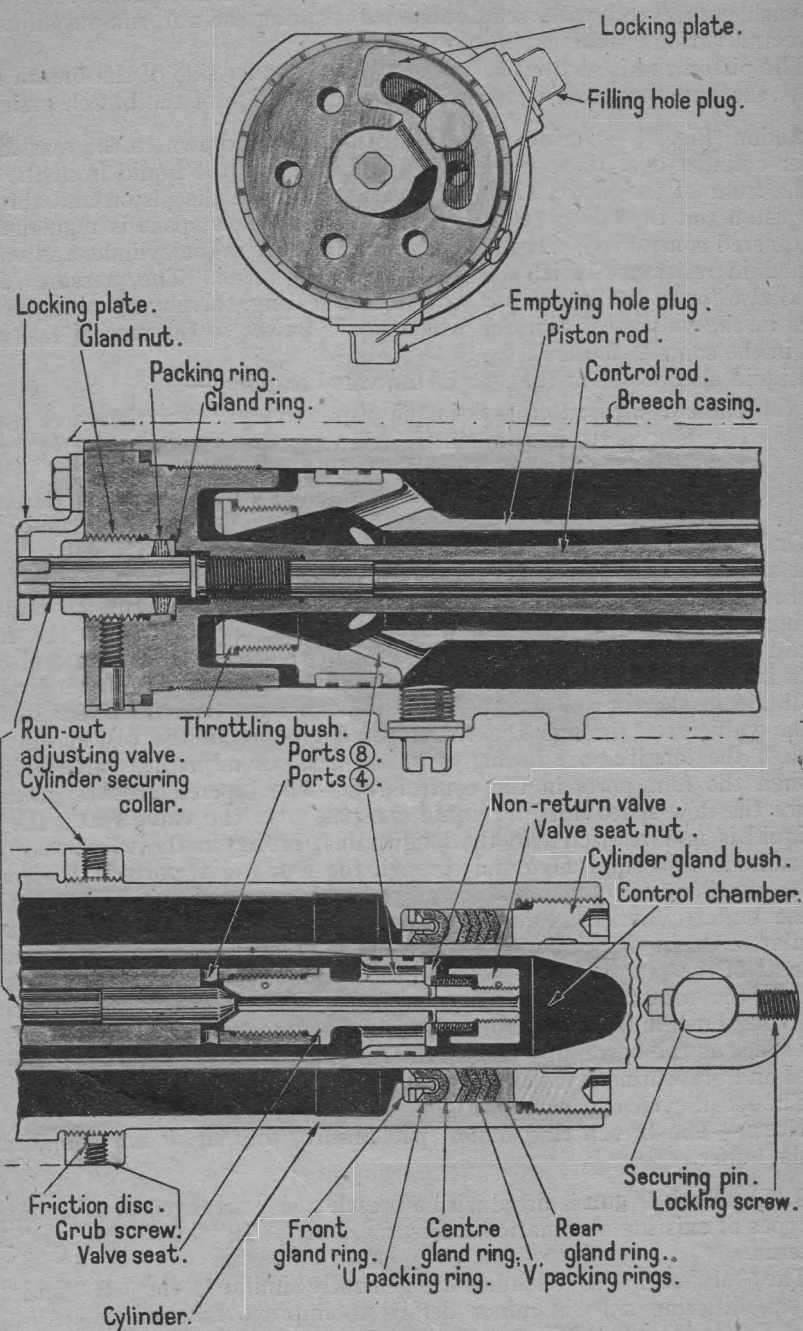
BUFFER.

FIG. 6.

# BUFFER ACTION

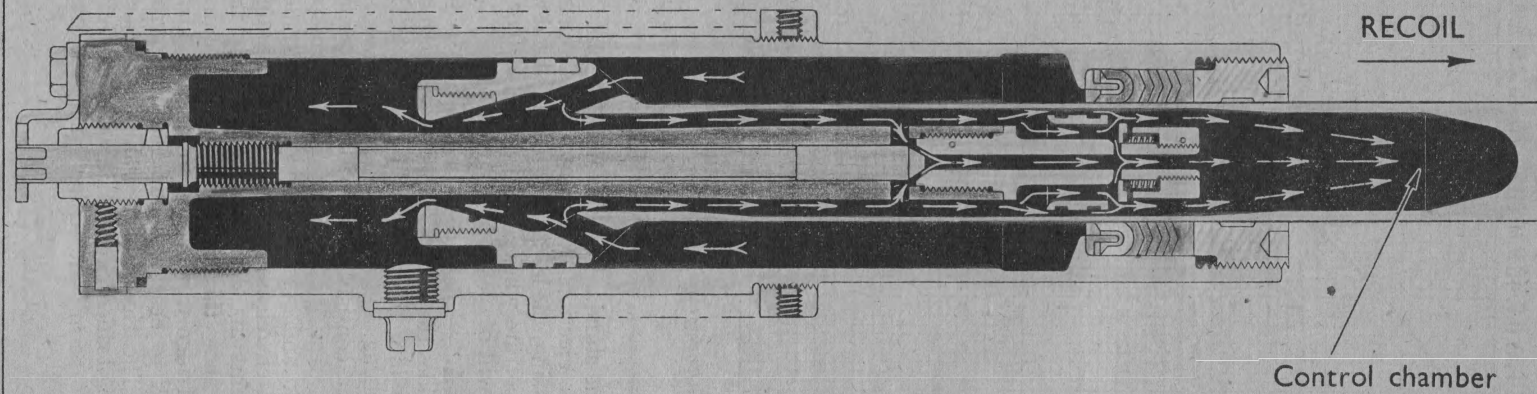


FIG. 7.



## RECOIL CYCLE FOR Q.F. 40-M.M. GUNS ON 40-M.M. A.A. MOUNTINGS.

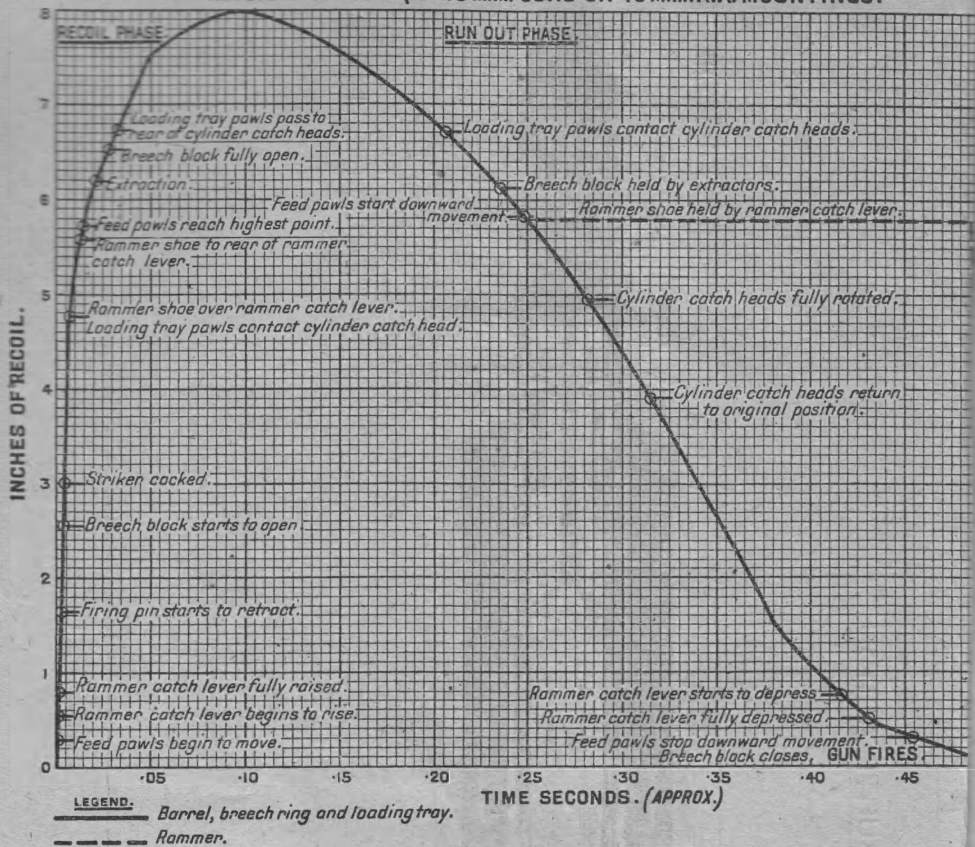


FIG. 8.

The "A" loader is the standard for the Mark I\* gun.

Two apertures for the ejection of the ammunition charger are cut, one on each side of the breech casing, the left aperture being used when an "A" loader is fitted and the right aperture when "B," "C," "M" or "M\*" loaders are fitted; the side not used will be closed by a cover.

**9. Automatic loader "A."**—The automatic loader (Fig. 9) receives ammunition in chargers; it provides the means of loading single rounds on to a loading tray and ramming them into the chamber of the gun. It is housed in the rear part of the breech casing.

The automatic loader consists of the following principal parts:—Base, frames (left and right), rear guide, front guide, crosspiece, loading tray, rammer, catch or check and release devices, feeding device, feed cylinder catches, feed cylinder catch release, rammer hand cocking device.

The firing arrangements are designed to disengage the catch and check levers from the rammer shoe, thereby releasing the rammer from the cocked position to load the cartridge which, by forcing the extractors to the front, releases the breech block to be raised and the cranks rotated under action of the closing spring. The right inner crank, as it arrives at the closed position, forces the spring-loaded check plunger to the left, thereby releasing the inner cocking lever to permit the striker spring to carry the striker on to the cap of the cartridge.

"A" AUTOMATIC LOADER.

Firing rod.

Feed pawl.

Stop pawl.

Front guide.

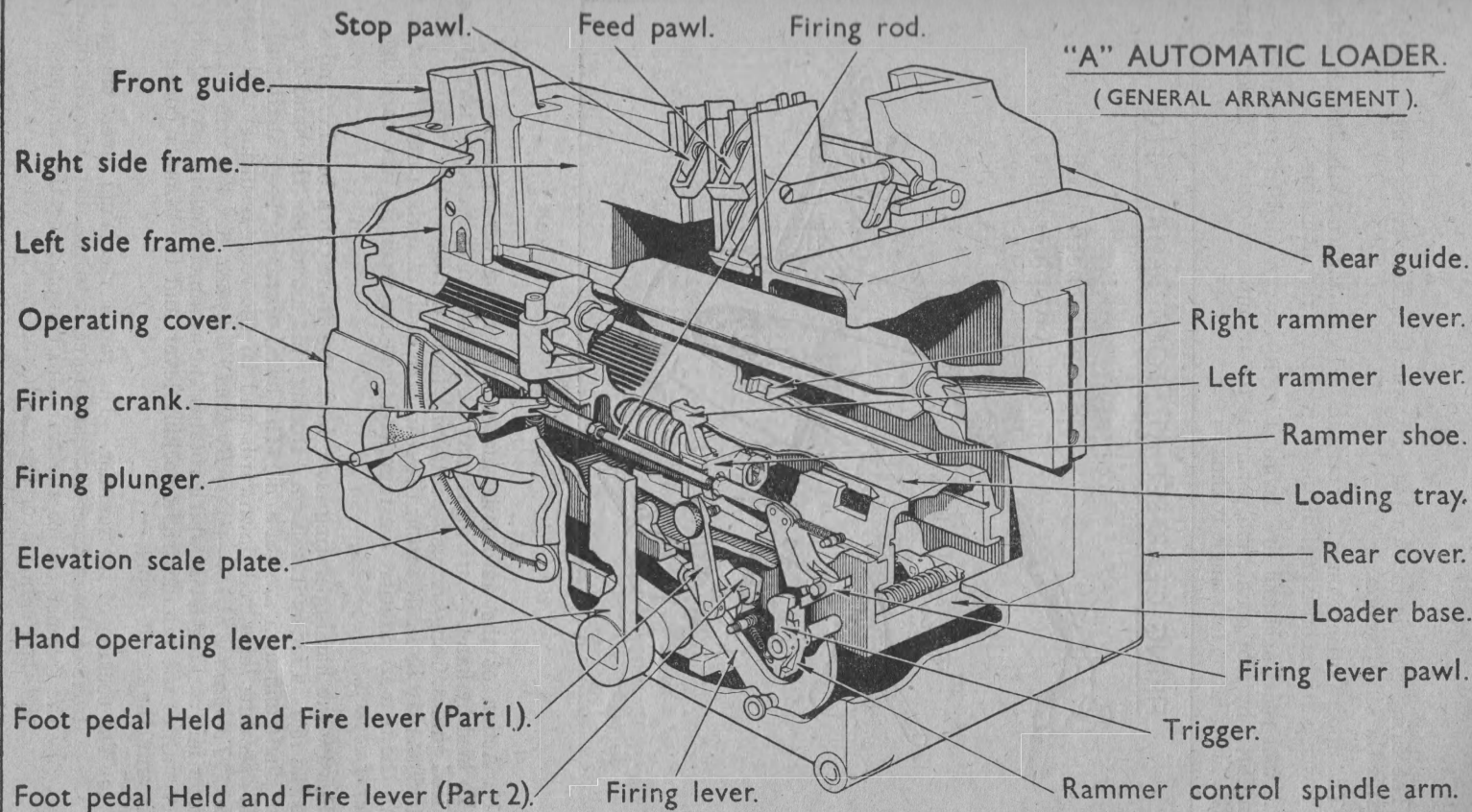


FIG. 9.

The firing gear is in two portions which make contact with each other outside the left trunnion.

The upper portion consists of certain fittings attached to the breech casing ; the lower portion consists of fittings attached to the mounting.

A **foot pedal held and fire device** (Fig. 10), is provided to prevent the gun being fired by foot pedal, and permit it to fire automatically or under control of the firing lever, *i.e.*, single rounds.

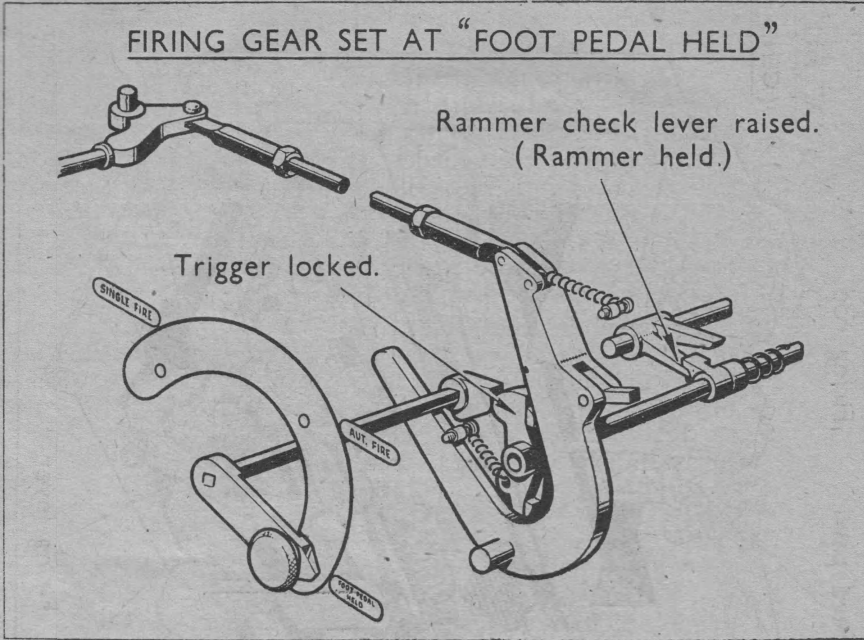


FIG. 10.

#### 10. Action of the automatic loader and firing arrangements (Fig. 11).

(1) **To load by hand.**—Cartridges may be placed on the loading tray through the feed guides, using chargers containing four cartridges ; alternatively, single cartridges may be loaded from the rear. In each case the rammer shoe must be to the rear to position the rammer levers for receiving the cartridge, *i.e.*, rammer cocked.

Release the hand-operating lever from the front catch bracket and rotate it to the rear as far as it will go. During this movement the hand-operating lever shaft and arm are rotated. The hand-operating lever shaft pulls the hand-operating lever rod downwards and to the rear, resulting as described under "*To open the breech—(b) (i) By hand,*" in para. 6. The arm rotates the rammer left cocking lever which rotates the rammer cocking lever shaft, the latter rotates the rammer right cocking lever and the rammer cocking lever shaft arm, the result being :—

- (a) **The cocking of the rammer.**—The rammer cocking levers engage the front of the rammer shoe and force it to the rear, thereby drawing the rammer rod to the rear and compressing the rammer spring, the shoe riding over the catch and check levers. As soon as the pressure on the hand operating lever is released, the rammer spring



carries the rammer rod and shoe forward until engaged by the feed control check lever or by the firing gear check lever.

NOTE.—The feed control check lever will not be operative if more than two cartridges are in the feed guides, or if the feed control thumb lever is set to the opposite direction to which the arrow on the rear guide is pointing; should the feed control lever not be operative, the rammer shoe will be carried slightly more to the front until engaged by the firing gear check lever. The catch lever is retained in the inoperative position by the loading tray which remains to the front.

- (b) **The releasing of the feed cylinders.**—The rammer cocking lever shaft arm forces the cylinder catch release link to the front, the link rotates the cylinder catch release spindle arm which rotates the spindle. The spindle rotates the two cylinder catch release levers which force the two cylinder catch release pistons to the front. The pistons rotate the cylinder catch arms which rotate the cylinder catch spindles, and at the same time increase the tension on the torsional springs. The spindles rotate the cylinder catch heads. The short arm of each head is rotated clear of the upper side of its respective feed cylinder.
- (c) **The opening of the breech.**—As soon as the hand operating lever has been rotated to the rear as far as it will go, the pressure is released to permit the rammer shoe to be engaged by a check lever and to permit the ramming levers to return to the receiving position, the levers having been forced open when the operating lever was fully rotated to the rear; the operating lever is now raised and engaged in the rear catch bracket. A cartridge in the feed guide is now forced between the feed cylinders into the loading tray. During this movement the rear ends of the cylinders are forced apart, the cylinders rotated a quarter of a turn and then returned to the receiving position by the feed cylinder spring-operated plungers; the spring-loaded pawls are raised to permit the cylinders to rotate a quarter of a circle and limit the rotary movement of the feed cylinders.

When the hand-operating lever is between the fully rotated position to the rear and the rear catch bracket, the arm on the hand-operating lever shaft prevents the firing lever being rotated to the rear and therefore, the trigger, under control of its spring, retains the rammer control spindle arm and check lever in the operative position, thus preventing the rammer shoe from moving forward. The returning of the hand-operating lever results in:—

- (i) The cocking levers are withdrawn from the rammer shoe.
- (ii) The cylinder catch release pistons are withdrawn from the cylinder catch arms and the cylinder catch spindles and heads, thus released, are rotated to normal positions under action of the torsional springs. The heads withdraw the pawls from the feed cylinders, the pawls being returned to normal positions by action of their springs, and the short arm of each head is rotated to engage the upper side of its respective feed cylinder, thereby preventing the cylinders from rotating.
- (iii) Remove the hand operating rod and crank towards the front.

The cartridge may be loaded from the rear after the rammer has been cocked and the hand-operating lever screwed in the rear catch bracket.

Remove the cartridge deflectors securing pin and rotate the deflector upwards until it rests on the rear cover.

Insert the cartridge on the loading tray until the rim is engaged in the slots in the rammer levers.

Rotate the cartridge deflector downwards and secure it by the pin.

The hand-operating lever is withdrawn from the rear catch bracket, rotated to the front and secured in the front catch bracket; this movement returns the hand-operating rod and crank to the front. The arm on the hand-operating lever shaft is now clear of the firing lever.

The catch lever is already inoperative due to the bevelled projection on the under side of the loading tray engaging the front end of the rammer releasing lever which has rotated the catch lever clear of the rammer shoe.

The feed control lever is made operative by the third cartridge in the feed guides or by operating the feed control thumb lever. The firing gear check lever may be withdrawn from the rammer shoe by manipulating the firing gear.

As soon as the rammer shoe is released, the rammer spring carries the rammer and shoe to the front until the rammer head engages the rammer buffer. The rammer shoe carries the rammer levers and cartridge forward, the cam guides in the loading tray open the rammer levers and the cartridge is released to travel forward, due to momentum, into the breech end of the barrel.

See "*To close the breech—By automatic,*" para. 6 (a) (ii).

## (2) Automatic loading.

(a) On firing, the barrel recoils to the rear and takes with it the breech ring and loading tray which carries the rammer. During this movement:—

- (i) See "*To open the breech—By automatic,*" para. 6 (b) (ii). The empty cartridge case is rejected.
- (ii) The bevelled projection on the under side of the loading tray disengages the front end of the rammer releasing lever which permits the rammer catch lever to be raised by its spring.
- (iii) The loading tray pawls ride under the long arms formed on the cylinder catch heads and are reasserted under the action of their springs in rear of the arms.
- (iv) The rammer shoe rides over the catch and release levers which are reasserted under action of their springs in front of the rammer shoe.
- (v) The rollers on the lower ends of the two feed rods ride in the eccentric grooves in the sides of the loading tray. The grooves raise the rollers and feed rods and the feed pawls ride over the cartridges in the feed guide, the pawls being reasserted by action of their springs as soon as a cartridge is passed.

(b) On run-out, the barrel takes with it the breech ring and loading tray. During this movement:—

- (i) The rammer head is temporarily held by the catch lever.
- (ii) The loading tray pawls engage the long arms formed on the cylinder catch heads, the heads are rotated so that the short arms are clear of the upper sides of the feed cylinders and the spring-loaded pawl in each head engages under the side of its respective feed cylinder.

Feed pawl holder  
Feed control lever  
Feed control thumb lever  
Feed control rod



"A" AUTOMATIC LOADER.  
DIAGRAMMATIC ARRANGEMENT.

"A" AUTOMATIC LOADER.  
DIAGRAMMATIC ARRANGEMENT.

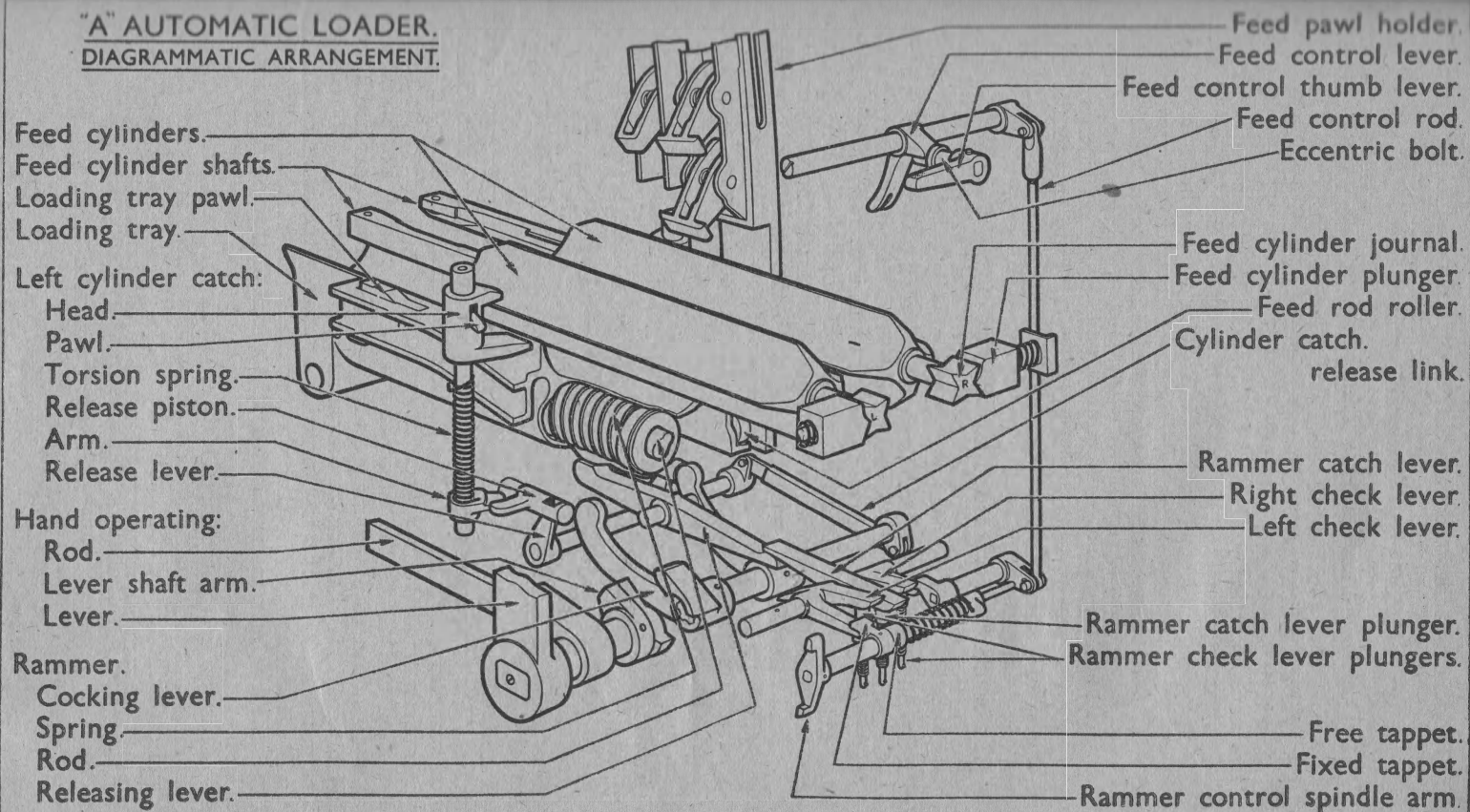


FIG. 11.



- (iii) The rollers on the lower ends of the two feed rods ride in the eccentric grooves in the side of the loading tray. The grooves force the rollers and feed rods downwards and the feed pawls force the cartridges in the feed guides over the stop pawls: the lowest cartridge, forcing the feed cylinders apart and rotating them a quarter of a circle, is loaded on to the loading tray. The feed cylinder spring-operated plungers return the feed cylinders to the receiving position. The spring-loaded pawls in the catch cylinder heads are raised to permit the cylinders to rotate a quarter of a circle and then limit the rotary movement of the feed cylinders.
- (iv) The loading tray pawls, after rotating the catch cylinder heads, ride by the long arms formed on the catch cylinder heads which, thus released, are rotated to normal positions under action of the torsional springs. The heads withdraw the pawls from the feed cylinders, the pawls being returned to normal positions by action of their springs, and the short arm of each head engages the upper side of its respective feed cylinder, thereby preventing the cylinders from rotating.
- (v) The bevelled projection on the under side of the loading tray engages the front end of the rammer shoe, and compresses the catch lever spring.
- (vi) As soon as the catch lever is withdrawn from the rammer shoe, the rammer spring carries the rammer and shoe to the front to be engaged by the feed control check lever, if operative, or the firing gear check lever if the firing gear is not operated. If both check levers are inoperative, the rammer shoe carries the rammer levers and cartridge towards the front until the rammer head engages the rammer buffer, the cam guides in the loading tray open the rammer levers and the cartridge is released to travel forward, due to momentum, into the breech end of the barrel. See "*To close the breech—By automatic,*" para. 6 (a) (ii).

### (3) To fire

(a) **Single round** (Fig. 12).—Place the foot pedal held and fire lever to the position marked SINGLE ROUND. Rotate the feed control thumb lever to the right, thereby rendering its check lever inoperative.

Place a round on the loading tray as described under "*To load by hand,*" para. 10 (1).

Operate the firing gear as far as it will go when the firing lever will rotate the trigger. The trigger will operate the check and release device to withdraw the firing gear check lever clear of the rammer shoe and then until the trigger pawl rides clear of the trigger when the latter, under action of its spring, reasserts itself and assists the check and release device to be returned to normal under action of the check lever spring. The firing gear check lever is therefore raised ready to engage the rammer shoe on recoil. On releasing the firing gear, the firing lever is returned to normal by the firing lever spring which was extended when the gear was operated; the pawl rides over the upper end of the trigger and is forced down to its normal position behind the trigger by its spring.

As soon as the firing gear check lever is withdrawn clear of the rammer shoe, the rammer spring reasserts itself, the rammer shoe carries the rammer levers and cartridge to the front until the rammer head engages the rammer buffer when the rammer levers are opened and the cartridge is released to travel forward, due to momentum, into the breech end of the barrel. The breech is closed and the striker released as described under "*To close the breech—By automatic,*" para. 6 (a) (ii).

# FIRING GEAR SET AT "SINGLE FIRE."

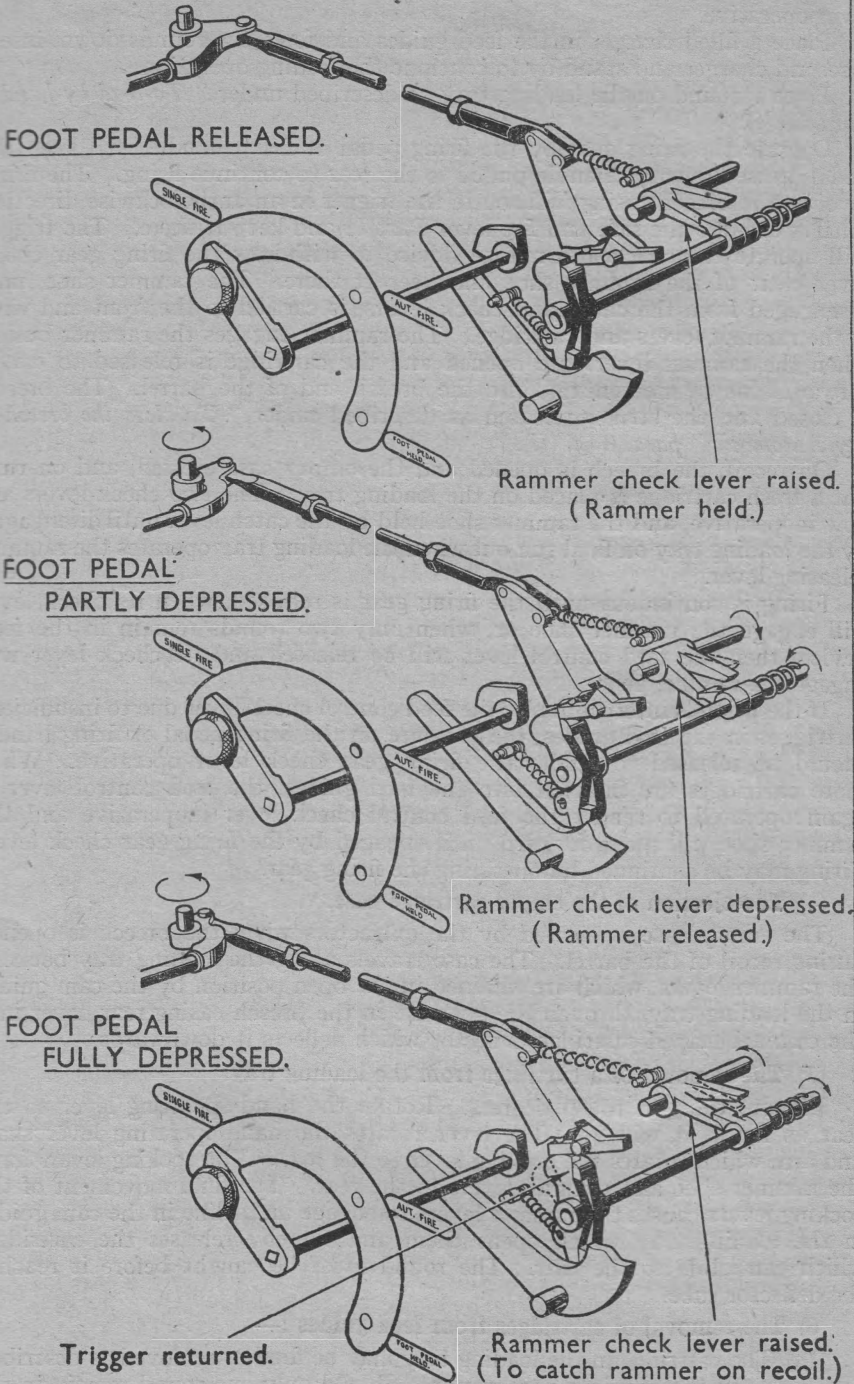


FIG. 12.

(b) **Automatic (Fig. 13).**—Place the foot pedal held and fire lever to the position marked AUT. FIRE.

Rotate the feed control thumb lever to the left thereby rendering its check lever operative.

Place a filled charger in the feed guides and force the rounds down, insert a second charger and stand by to continue the feeding operation.

Place a round on the loading tray as described under "*To load by hand,*" para. 10 (i).

Operate the firing gear by the firing pedal or firing handle, and keep the pedal pressed down or handle pulled to the rear to continue firing. The firing lever in the breech casing will rotate the trigger in an anti-clockwise direction until it engages the safe and fire lever Part II and keep it there. The trigger will operate the check and release device to withdraw the firing gear check lever clear of the rammer shoe and keep it there. The rammer shoe, now disengaged from the catch and check levers, is carried to the front and with it the rammer levers and cartridge. The rammer engages the rammer buffer, when the rammer levers are opened and the cartridge is released to travel forward, due to momentum, into the breech end of the barrel. The breech is closed and the striker released as described under "*To close the breech—By Automatic,*" para. 6 (a) (ii).

On recoil, the breech is opened and the empty case ejected, and on run-out a fresh cartridge is placed on the loading tray. The two check levers are now inoperative, and the rammer shoe held by the catch lever until disengaged by the loading tray on final run out when the loading tray operates the rammer releasing lever.

Firing is continuous until the firing gear is released, when its check lever will engage the rammer shoe or, when only two rounds remain in the feed device, then the feed control lever will be released and its check lever will engage the rammer shoe.

If the firing is interrupted by the feed control check lever due to insufficient cartridges in the feed guides, the pressure on the firing pedal or firing handle should be released to render the firing gear check lever operative. When more cartridges are inserted into the feed guides, the feed control lever is again operated to render the feed control check lever inoperative and the rammer shoe will move forward until engaged by the firing gear check lever. Firing may be continued by operating the firing gear.

#### (4) **The ejection of the empty cartridge case.**

The empty case is ejected by the extractors when the breech is opened during recoil of the barrel. The case travels along the loading tray between the rammer levers, which are retained in the open position by the cam guides in the loading tray, through the aperture in the breech casing rear cover into the channel-shaped cartridge deflector which deflects it downwards.

#### (5) **The removal of a cartridge from the loading tray.**

Elevate the gun to 30 degrees. Rotate the hand-operating lever to the rear as far as it will go. The lever rotates the hand-operating lever shaft and arm which rotates the cocking lever to the rear. The cocking levers force the rammer shoe and rammer levers to the rear. The final movement of the cocking levers causes the rammer levers to engage an incline in the cam guides in the loading tray which opens them and thereby releases the cartridge, which can slide to the rear. The round must be caught before it reaches the deflector tube.

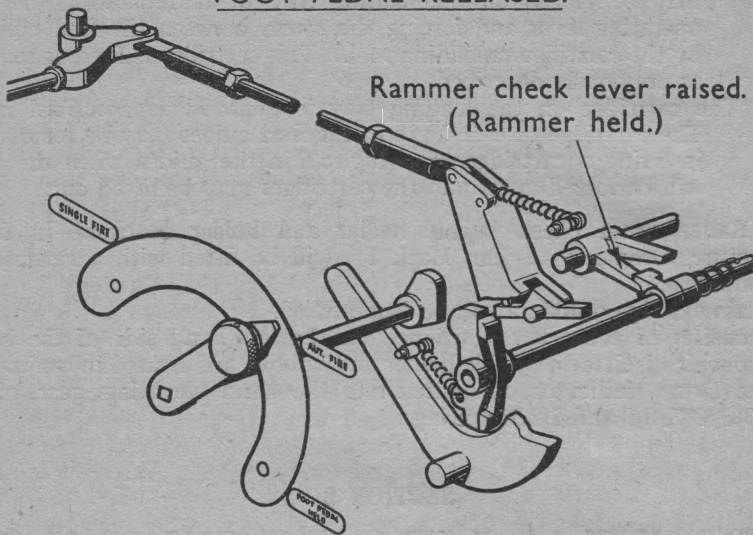
#### (6) **The removal of cartridges from feed guides :—**

- (a) The cartridge in the loading tray may be fired or removed as described in the previous paragraphs. Should only one round remain in the



# FIRING GEAR SET AT "AUT. FIRE"

## FOOT PEDAL RELEASED.



## FOOT PEDAL FULLY DEPRESSED.

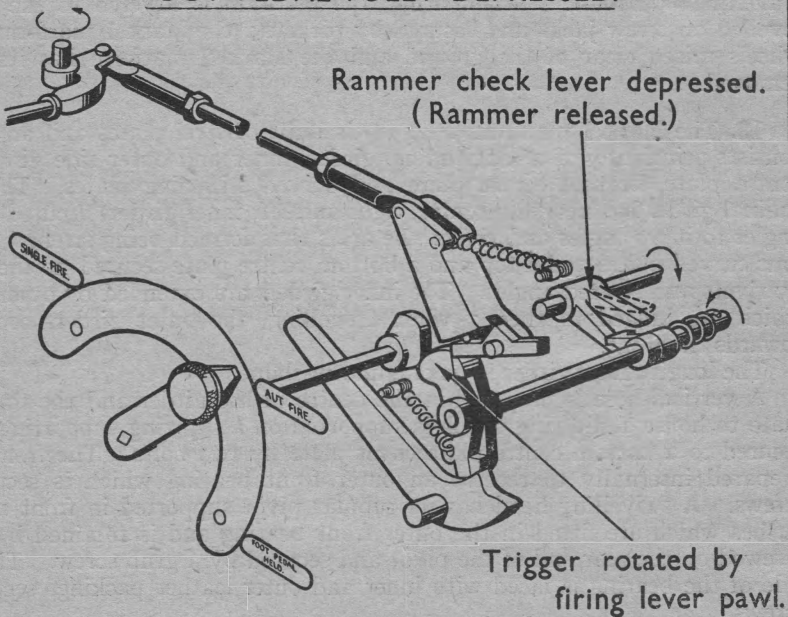


FIG. 13.

feed guides and the round on the tray is to be fired, the feed control thumb lever must be rotated to the right to render its check lever inoperative, when the rammer shoe will move forward to be engaged by the firing gear check lever. Press down the firing pedal, or operate the firing handle on the mounting and the cartridge will be loaded and fired. The round in the feed guides may be placed on the loading tray by manipulating the hand operating lever and forcing the round between the feed cylinders by the cartridge unloading tool. This cartridge is fired or removed as previously described.

- (b) The cartridge on the loading tray is removed as described in (a). The cartridge or cartridges in the feed guides may be removed by inserting a cartridge removing tool in the guides when the pawls will be forced apart and the cartridges may be lifted out.

**11. Range drum check bubble holder and holder bracket.**—In future manufacture, Ordnance 40-mm. Mark 1\* will be fitted with a range drum check bubble.

Certain existing ordnance will be found fitted.

It consists of a bracket positioned on the left hand side of the breech casing to which is fitted a bubble holder and bubble, and is used in conjunction with the Drum, indicator, range fitted to the hand elevating gear of the Marks 3/6, 3/7, 3/8 and 4/2 Mountings.

## SECTION 2

### MOUNTINGS, 40-MM A.A., MARKS 1, 1A, 1B, 3, 3/1, 3/2, 3/3 AND 4 AND PLATFORMS, MARKS 1, 1A, 2, 3 AND 4

**12.** The mountings are carried on Marks 1, 1A, 2, 3 and 4 platforms, each of which is fitted with four wheels for travelling purposes. The platforms are designed for rapid change from the travelling to firing and firing to the travelling positions. When firing, the platform is lowered to the ground, levelled on screw jacks and secured by pickets; the Mark 1 platform has its wheels raised clear of the ground and the Mark 2 platform has its wheels removed.

**13. The Mark 1 platform** (Fig. 14) is built of steel plates and angles. It consists principally of a longitudinal girder, inner and outer side girders, top centre plate, bottom centre plate and curved stiffening plates. The longitudinal girder has near the centre, right and left inner girders secured at right angles to it by angles and rivets, the arms thus formed being strengthened by four curved plates and a top and a bottom centre plate secured to the girders by rivets and riveted angles. The inner girders are extended by outer girders which are hinged to them; when travelling, the outer girders are folded towards the front.

The longitudinal girder is rectangular in shape.

A vertical hole is prepared in the centre of the girder and the top centre plate to house a slip ring which is supported on a slip ring supporting stirrup secured to a bottom centre plate cover plate by two bolts. The front end is prepared internally to receive an outer front bearing which is secured by screws. A swivelling head has its tubular pivot supported in front and rear bushes which are fitted in the outer front bearing and is retained by a nut screwed on the rear end of the pivot and secured by a grub screw. The front side of the bearing is faced with inner and outer leather packings secured by screws.

An aper  
and access  
is closed by  
tube adapts  
The re  
bearing br  
are lined w

14. The  
cups and  
upper and

15. Spin  
and on the  
the mount

16. Low  
jacks are s  
collars secu

17. A No  
is a tubular  
two keyway  
balancing g  
is supported  
frame longit  
with fittings  
vertical mo  
mounting re

18. A No  
differs from  
ment of ste  
collar forme  
and caps of  
bracket plun  
The shac  
222 axletree.

19. The  
engine draug

20. The  
casing, spring  
is at the rear  
thrust collar  
lever when ra

21. The g  
it is also used

22. Front  
the front of  
attached side  
is semi-circul  
locking plates

An aperture in the upper side of the girder facilitates assembly of the nut and access to the spring case of the front axle balancing gear. The aperture is closed by a cover secured by bolts. The bearing is lubricated through two tube adapters fitted with lubricators.

The rear end has a transverse bearing for the rear axletree for which a bearing bracket is riveted on each side. The brackets have capsquares and are lined with semi-circular bushes.

14. The **swivelling head** is prepared with front axletree bracket fitted with capsquares and bushes. A jack supporting cylinder is fitted and attached by upper and lower collars.

15. **Spirit level bubbles** are fitted on each end of the longitudinal girder and on the outer ends of the outer side girder, they are used to assist in levelling the mounting. In future manufacture these will be omitted.

16. **Levelling screw jacks** are provided for levelling the platform. The jacks are supported in vertical cylinders riveted to upper and lower flanged collars secured near the ends of the longitudinal and outer side girders.

17. A **No. 222 special axletree** is at the front end of the platform frame. It is a tubular steel bar, in the centre of which a bearing surface is prepared with two keyways for keys and attachment of a toothed arc on the front axle balancing gear. A bearing surface on each side of the centre bearing surface is supported in trunnion bearings on the swivel head attached to the platform frame longitudinal girder. A suspension spring and spring rod lever together with fittings are housed in each end of the axletree bar, and allows each wheel vertical movement independent of the axletree bar, thereby keeping the mounting reasonably steady when travelling over uneven ground.

18. A **No. 223 special axletree** is at the rear end of the platform frame. It differs from the No. 222 in that the tubular steel bar is not prepared for attachment of steering gear axletree clamps, but has two bearing surfaces with a collar formed on the outside of each surface for attachment of foot brackets and caps of gun stays. A hole is prepared in each bearing surface for a foot bracket plunger to engage.

The shackle and stub axle crosshead is also different from those of the No. 222 axletree.

19. The **steering gear** is attached to the front axle and controlled by an engine draught connector.

20. The **No. 30 engine draught connector** consists principally of a spring casing, springs, outer and inner tubes and a swivelling eye. The spring casing is at the rear end of the connector and houses an inner and outer spring and thrust collar. The engine draught connector and steering gear are used as a lever when raising or lowering the platform.

21. The **gun stay** is used to secure the breech casing to the rear axletree, it is also used as a lever when raising or lowering the platform.

22. **Front axle balancing gear** is designed to assist in raising or lowering the front of the platform. Two toothed arcs, semi-circular in shape, are attached side by side to the centre of the front axletree by an arcs lever which is semi-circular and is secured to the arc by bolts, the bolts being secured by locking plates.



# MARK I PLATFORM.

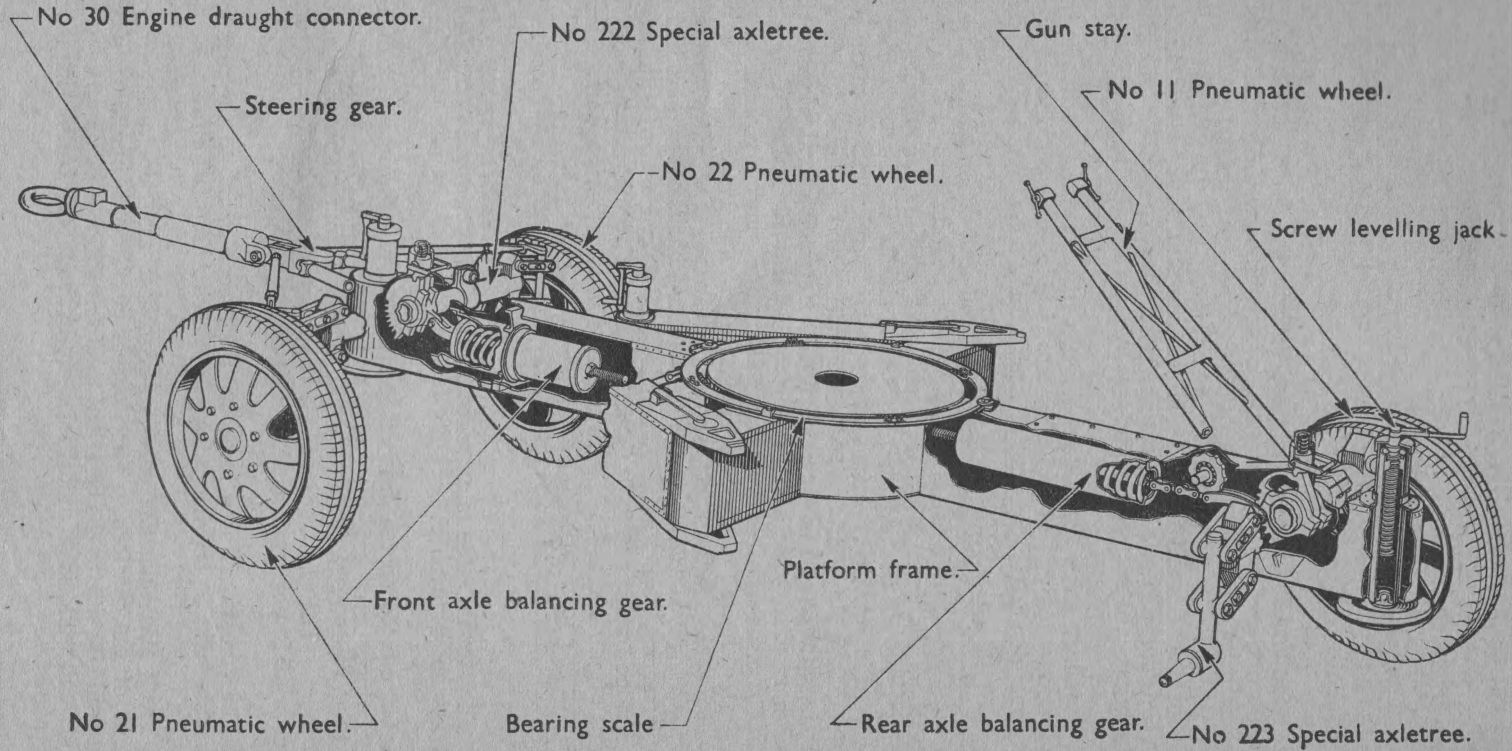


FIG. 14.

24. The front of the platform is attached to the bearings in the axle and as the latter work front balancing gear a handle for a handle for the spring case bearing against the axle against the handle to lock the handle in engagement.

25. The front of the platform is attached to the bearings in the axle and as the latter work front balancing gear a handle for a handle for the spring case bearing against the axle against the handle to lock the handle in engagement.

26. The front of the platform is attached to the bearings in the axle and as the latter work front balancing gear a handle for a handle for the spring case bearing against the axle against the handle to lock the handle in engagement.

27. The front of the platform is attached to the bearings in the axle and as the latter work front balancing gear a handle for a handle for the spring case bearing against the axle against the handle to lock the handle in engagement.

28. The front of the platform is attached to the bearings in the axle and as the latter work front balancing gear a handle for a handle for the spring case bearing against the axle against the handle to lock the handle in engagement.

29. The front of the platform is attached to the bearings in the axle and as the latter work front balancing gear a handle for a handle for the spring case bearing against the axle against the handle to lock the handle in engagement.

30. The front of the platform is attached to the bearings in the axle and as the latter work front balancing gear a handle for a handle for the spring case bearing against the axle against the handle to lock the handle in engagement.

A spring compressing rod is attached to the projection on the arc lever. The spring case is housed in the rear of the swivelling head, the front end bearing against an angle collar riveted inside the swivelling head. The eccentric operating handle has a hole prepared in the left crank for a spring-loaded handle locking plunger to engage. A handle locking catch is provided to lock the handle in the down position, that is, when the toothed projection is in engagement with a recess in the toothed arc.

23. The **rear axle balancing gear** is designed to assist in raising or lowering the front of the platform. A toothed arc, in two semi-circular parts, is attached to the centre of the rear axletree by bolts. Two keys are fitted in keyways in the axletree to engage keyways in the arc, thus ensuring the axletree and arc rotate together. The toothed portion of the arc is connected to the compressing spring rod by means of chain links and a sprocket chain, the latter working on a sprocket wheel. The cap is prepared similarly to the front balancing axle gear for a spring-loaded plunger, eccentric, etc.; also for a handle locking catch to lock the handle in the down position.

24. The **brake gear** is of the Lockheed type, and consists generally of a master cylinder in which hydraulic pressure is generated, wheel cylinders operating the brake shoes, a supply or reserve tank by which the system is maintained full of fluid, and the "line" consisting of copper tubing, flexible hoses and unions interposed between the master cylinder and the wheel cylinders.

#### Wheels.

25. The **No. 10 pneumatic wheel** is fitted on the left end of the rear axletree. It comprises a No. 15 detachable anti-friction wheel hub and a No. 6 detachable wheel. The No. 15 hub consists principally of a stub axle, bearings, hub and brake drum with cover plate. The hydraulic brake wheel cylinder is a component part of the No. 15 hub.

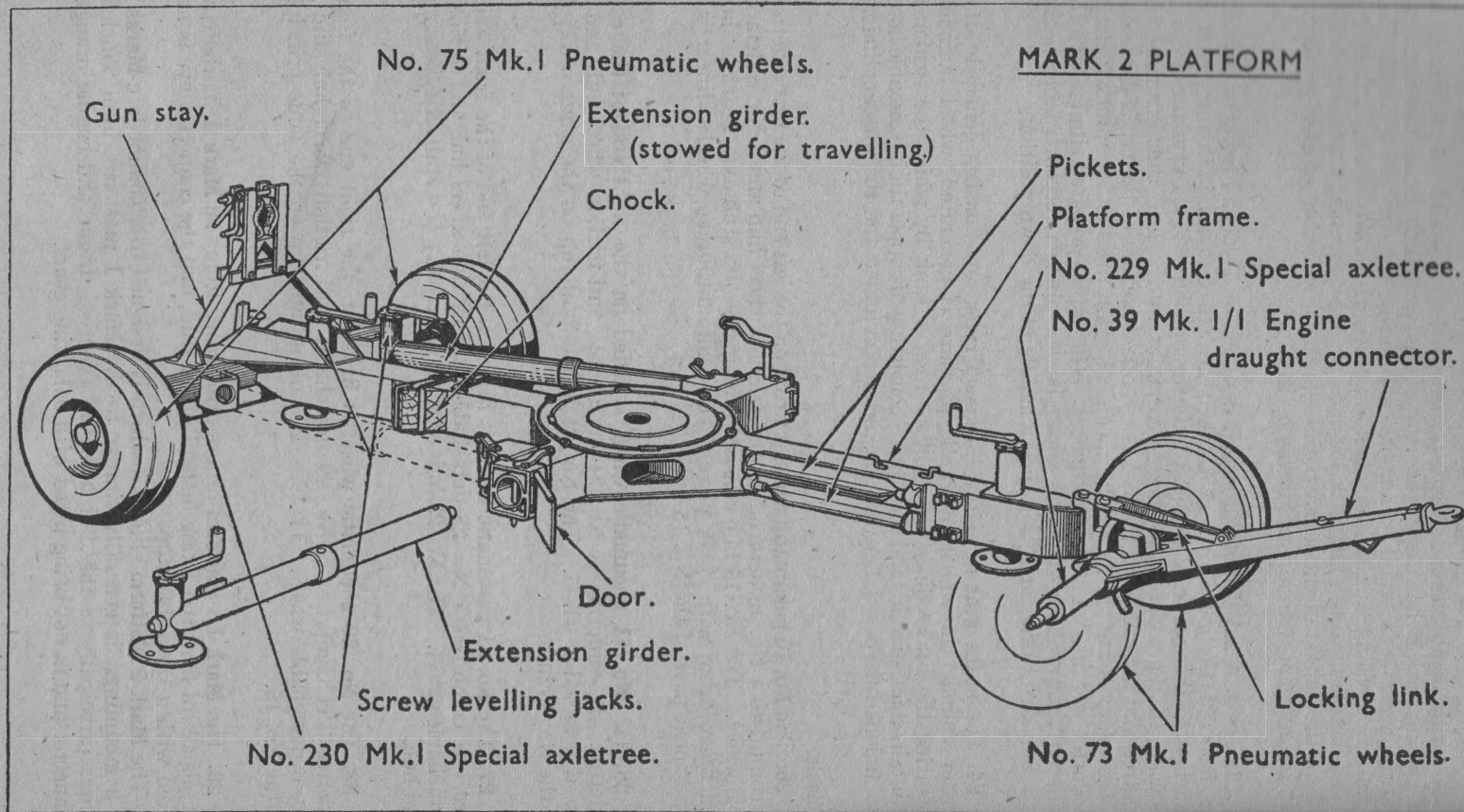
26. The **No. 11 pneumatic wheel** is fitted on the right end of the rear axletree. It comprises a No. 21 detachable anti-friction wheel hub and a No. 6 detachable wheel. The No. 21 hub is built up on the same principle as the No. 15 hub.

27. The **No. 21 pneumatic wheel** is fitted on the left end of the front axletree. It comprises a No. 28 detachable anti-friction wheel hub and a No. 6 detachable wheel. The No. 28 hub consists principally of a stub axle, bearings and hub.

28. The **No. 22 pneumatic wheel** is fitted on the right end of the front axletree. It comprises a No. 29 detachable anti-friction wheel hub and a No. 6 detachable wheel. The No. 29 hub is built up on the same principle as the No. 15.

29. The **Mark 1A platform** differs principally from the **Mark 1** in that the wheels are of five stud fixing instead of six stud, and the connector eye is not fitted with a shearable stop.

The **Mark 2 platform** (Fig. 15) which is designed to accommodate **Marks 1 to 3** mountings, is generally similar to the **Mark 1** platform, from which it differs principally in the design of the axletrees, frame and engine draught connector and in not being fitted with balancing gears.



31. The Marks 1 to 4 principally in the No. 41 eye, whereas provided with the tow operate and towing vehicle When it down suffi towing eye When it to the No. 4 between the of the forme The han locked by a The bra thereas the The axle and 230) of system is in platform it

The front are not fitte removable. No. 73 pu and No. 75 i

The exte in the fuing side of the p The front fabricated in extension gir on each end are connecte The No. 1 on each end are connecte The No. 1 on each end are connecte The No. 1 on each end are connecte The No. 1 on each end are connecte



30. The **No. 229 special axletree** (front) differs from that of the **No. 222 special axletree** of the **Mark 1** platform in that the former is welded to the **No. 39 Mark 1/1** or **Mark 1** engine draught connector, whereas the latter axletree is connected to the **No. 30** engine draught connector by a pin. The **No. 39 Mark 1/1** engine draught connector differs from the **Mark 1** in being fitted with a locking link to hold the engine draught connector up at an angle of approximately **15** degrees for greater ease in manhandling.

The steering is effected by the engine draught connector, the axletree swivelling on a pin in the steering head whereas in the **Mark 1 platform**, although controlled by the engine draught connector through steering rods, each stub axle swivels on its own pin.

The **No. 230 special axletree** (rear) is a plain tube with a stub axle welded on each end, whereas the stub axles on the **Mark 1 platform** axletree (**No. 223**) are connected to the axle tube by spring shackles.

The frame differs from that of the **Mark 1 platform** chiefly in that it is fabricated instead of riveted, the former also being fitted with two detachable extension girders.

The extension girders are fitted to the frame for steadying the equipment in the firing position and when travelling are removed and stowed on each side of the platform frame.

The front and rear axle balancing gears incorporated in the **Mark 1 platform** are not fitted, as, on jacking up the **Mark 2 platform**, the wheels are easily removable.

**No. 73 pneumatic wheels** are fitted to the **No. 229 special axletree** (front) and **No. 75 pneumatic wheels** to the **No. 230 special axletree** (rear).

31. The **Mark 3 platform** (Fig. 16) which is designed to accommodate **Marks 1 to 4** mountings, is generally similar to the **Mark 2 platform**, differing principally in being fitted with a hand and over-run brake operating gear on the **No. 41** engine draught connector which is provided with a special towing eye, whereas the **No. 39** engine draught connector on the **Mark 2 platform** is provided with an ordinary towing eye.

The towing eye of the **No. 41** engine draught connector is designed to operate and apply the brakes when the equipment tends to over-run the towing vehicles.

When the retarding effect of the brakes causes the equipment to slow down sufficiently, the towing vehicle again takes charge and the pull on the towing eye releases the brakes.

When it is desired to cut out the over-run gear, a yoke, which is attached to the **No. 41** engine draught connector by a short chain, is placed in position between the towing eye and the connector, thus preventing any movement of the former.

The handbrake can be applied independently of the over-run gear and is locked by a pawl and ratchet quadrant.

The braking system of the **Mark 3 platform** is mechanically operated, whereas the braking systems of the **Marks 1 and 2 platforms** are hydraulic.

The axletrees (**Nos. 387 and 388**) are generally similar to those (**Nos. 229 and 230**) of the **Mark 2 platform**, varying principally in that the braking system is incorporated in the front axletree (**No. 387**) whereas in the **Mark 2 platform** it is fitted in the rear axletree (**No. 230**).

**MARK 3 PLATFORM**  
 (Showing difference from MK 2 Platform)

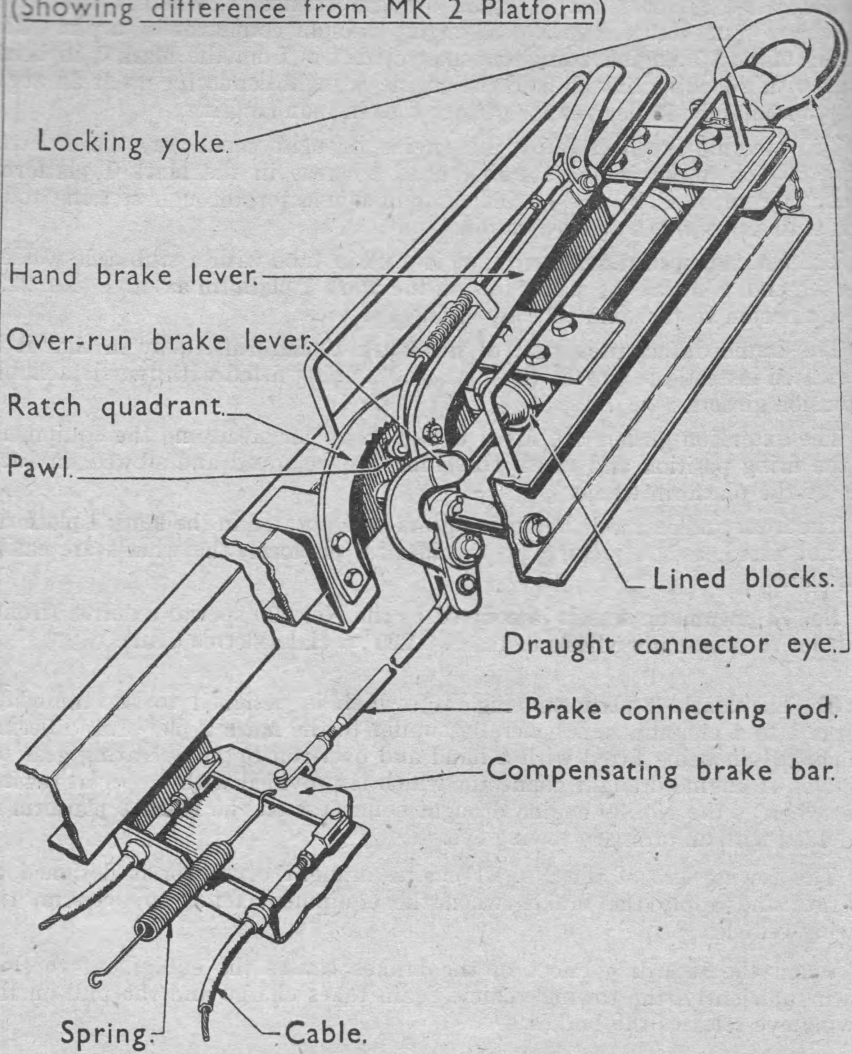


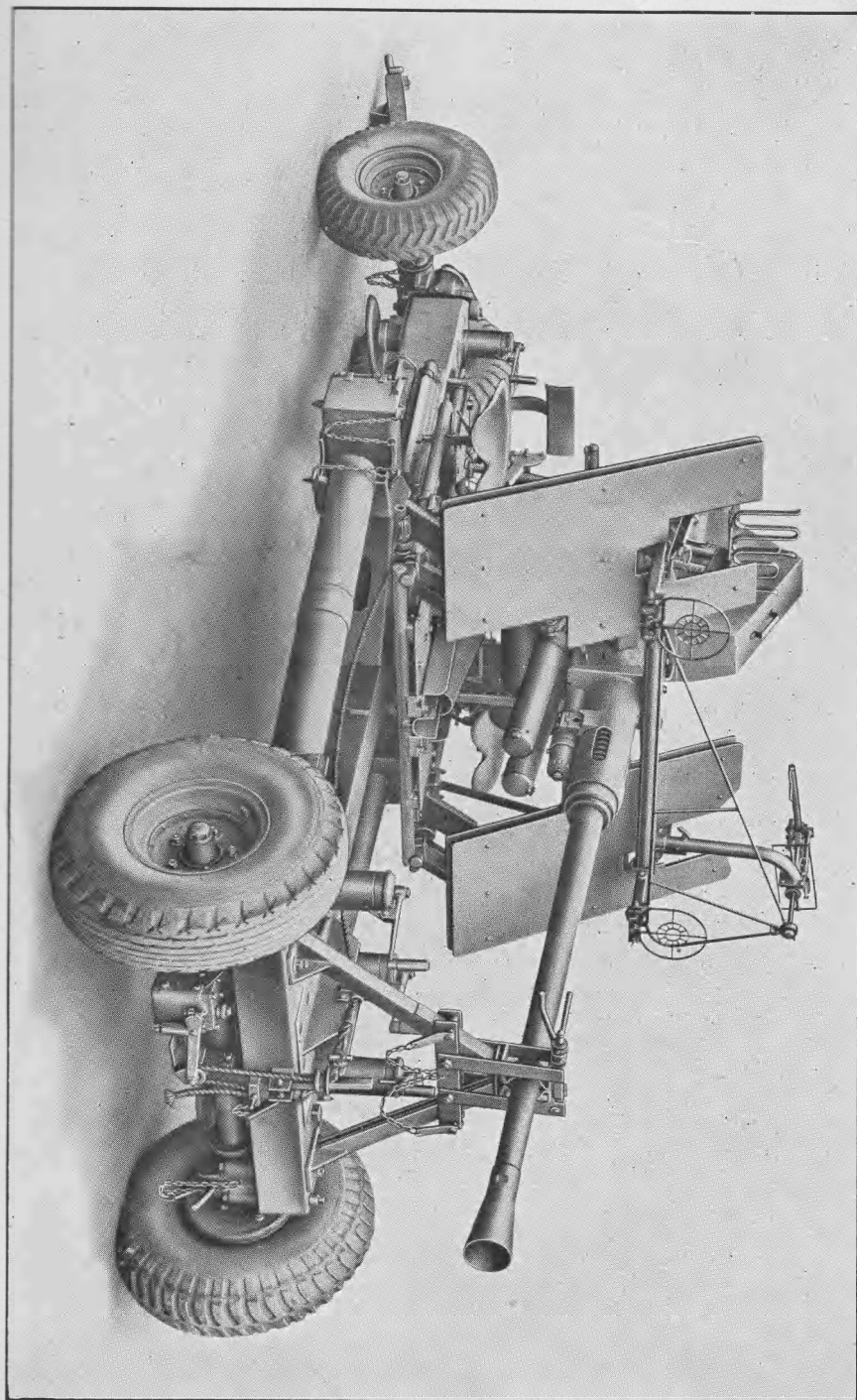
FIG. 16.

32. The **Mark 4 platform** (Fig. 17) which is designed to accommodate **Marks 1 to 4 mountings**, is the **Mark 3 platform** modified to allow for close stowage purposes.

The platform frame has been modified so that the centre forms a nucleus to which is attached the extension front, extension rear, and the extension girders.

The extensions front and rear are fitted with tubular steel connectors which fit into the ends of the centre frame, being locked in position by pins.

Four additional screw levelling jacks are used in conjunction with the extension girders for steadying the equipment in the firing position.





# MARK 4 PLATFORM.

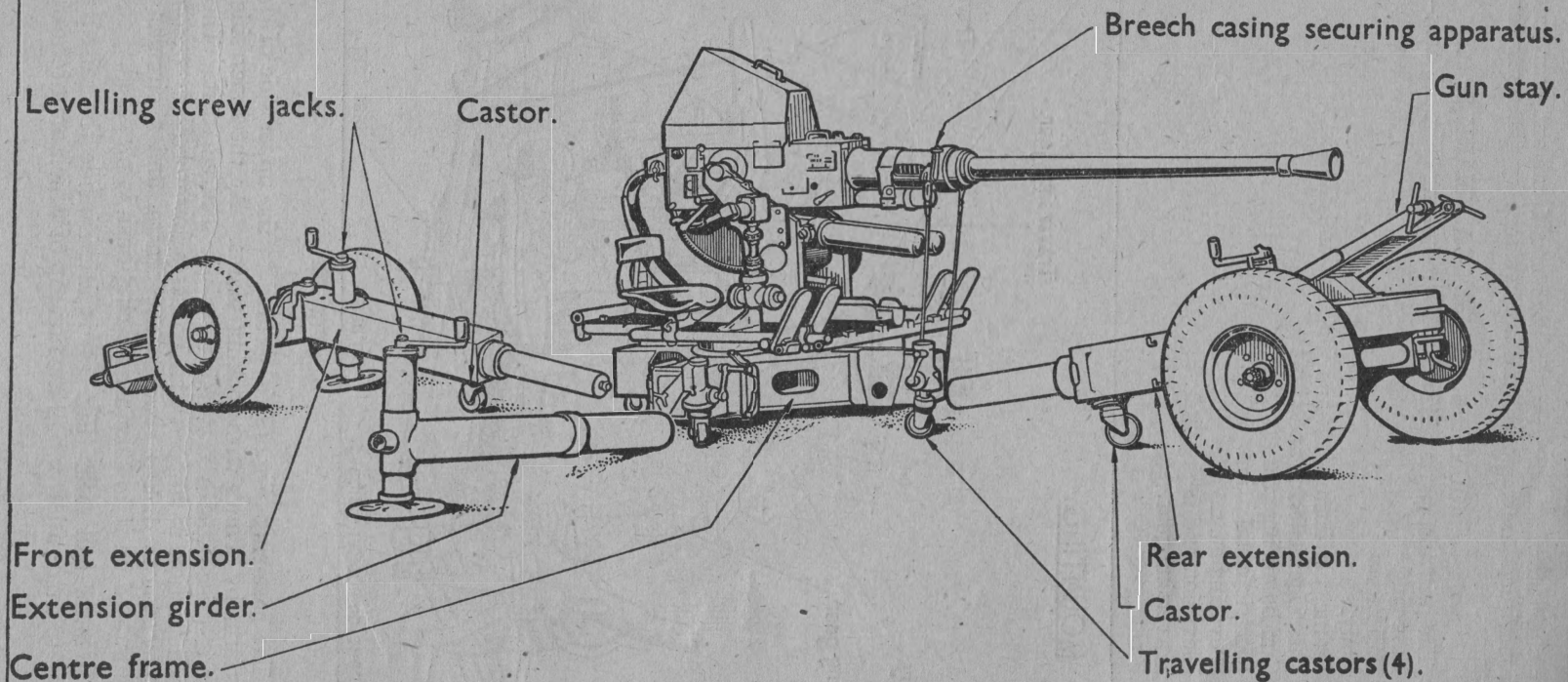


FIG. 17.

For close stowage purposes, the axletree, front and rear extensions and extension girders are removed and are replaced by the screw levelling jacks with castors.

### MOUNTING, 40-MM. A.A., MARK 3

33. The principal parts of the Mark 3 mounting (Fig. 18) are :—

- Base ring.
- Ball racers.
- Body.
- Frame, platform, seats and footrests and shields.
- Cartridge deflector and chute.
- Gun balancing gear.
- Electric installation.
- Elevating gear.
- Elevation and depression stops.
- Traversing gear.
- Firing gear.

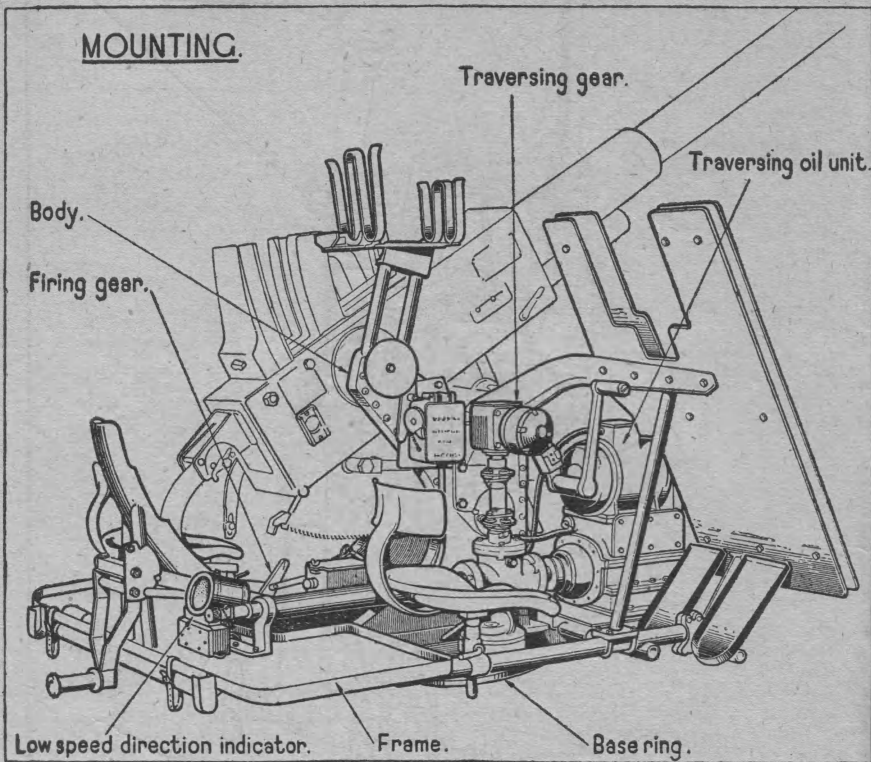


FIG. 18.

34. The **base ring** (Fig. 19) is secured to the upper side of the top plate of the platform by screws with locking plates. At the inner side of the flange the ring is raised and a traversing rack is secured to it. The inner side of the raised portion is stepped and houses a **lower ball racer** and ball bearing cage. The ring is dished towards the centre, and a circular aperture with a flange formed on it to take a base ring bush is prepared.

35. A **lower ball racer** (Fig. 19) is fitted inside the raised portion of the base ring to carry a lower ball race on top of which an intermediate ball racer

is assembled  
the upper

36. The  
principally  
plate secu

Crac  
Bree  
trunn



Bottom  
Frame  
Base r

Steel tru  
sing trunn  
Steel tru  
of the b  
The left  
ars.  
(S.O. 1708)

is assembled. An upper ball race is carried on the intermediate ball racer, the upper racer being formed on the traversing rack.

36. The **body** (Fig. 19) is built up of steel plates and angles. It consists principally of left and right sides connected by a cross tube and has a bottom plate secured to the sides by bolts.

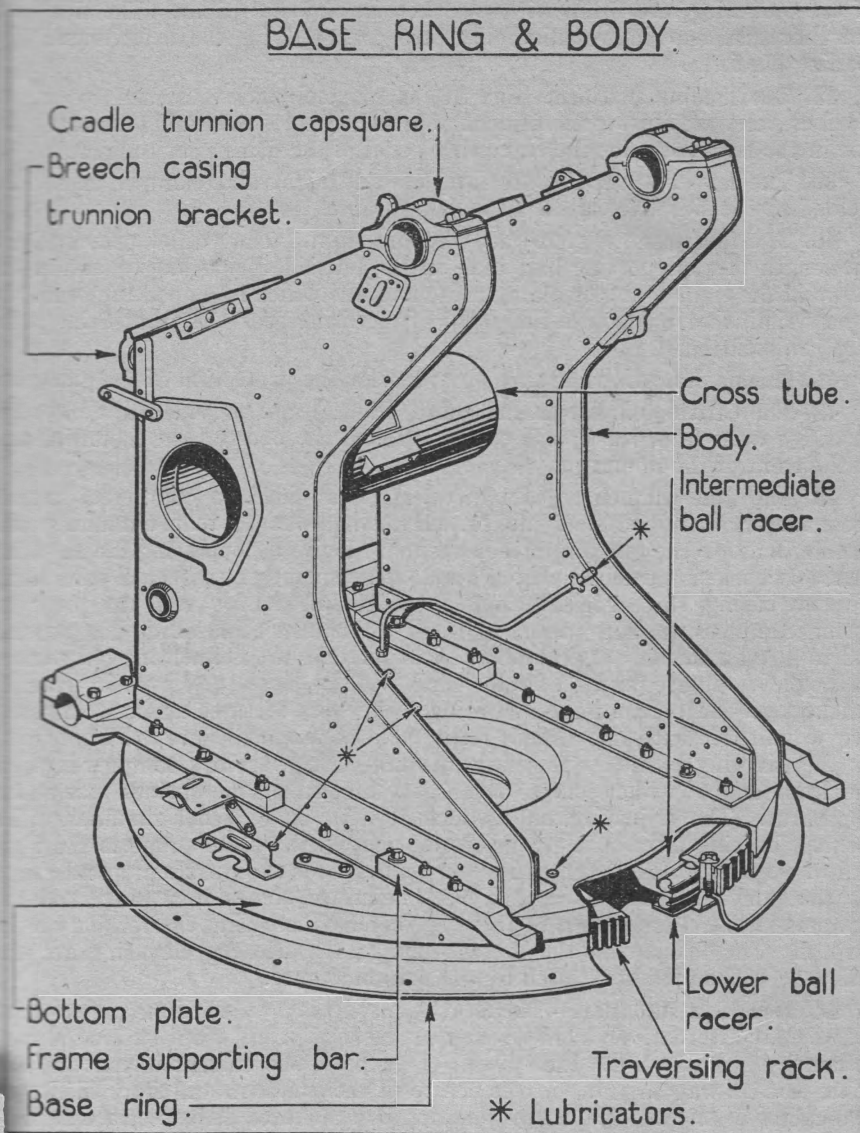


FIG. 19.

Steel trunnion brackets with capsquares are fitted to house the breech casing trunnions.

Steel trunnion brackets with capsquares are also fitted to the front of each side of the body to house the gun balancing gear trunnions.

The left side is prepared for the attachment of the elevating and firing gears.

(S.O. 1708)

C 2



The right side is prepared for the attachment of the traversing gear.

**37. A supporting frame** (Fig. 19), rectangular in shape, is built up of steel bars welded together. It is attached to the body by four frame supporting bars. Two deflector chute supporting angles, right and left, are secured to the front and intermediate cross bars. The side bars, in rear of the centre of the mounting, are fitted with a socket for the seat pillar. The side bars, rear bar and rear intermediate bar, are prepared for the attachment of a loading platform.

**38. The loading platform** (Fig. 20) is of steel plate stiffened by angles. Various holes are cut for the fitment of attached parts, including a rectangular one in the left centre for the rear firing pedal of the firing gear to operate.

**39. The layers' seats** (Fig. 20) are left and right and clamped in sockets welded to the side bars of the supporting frame.

**40. The foot rests** (Fig. 20) are left and right. They differ principally in the length of a supporting bar, that on the left side being longer, and in the shape of the right foot rest plate on the left side which is shaped to permit the layer's right foot to operate the pedal of the firing gear. A front firing pedal stop is also fitted.

**41. Shields**, left and right, are provided for the protection of the gun crew.

**42. The cartridge deflector and chute** (Fig. 20) are provided to deflect the cartridge cases from the breech casing through the body of the mounting and to the front of the mounting.

**43. The gun balancing gear** (Fig. 21) is provided to counteract muzzle preponderance and that of the breech casing, due to rear trunnions, and thereby balance the gun and breech casing to facilitate operating the elevating gear. It consists principally of two balancing spring presses, each comprising a spring casing, three spiral springs with dividing bushes, rod, end plate and spring compressing plate, also a rod end to connect each spring compressing rod to a rod connector assembled one on each end of a connecting bar secured to the elevating arc on the breech casing; the presses are secured in trunnion brackets on the body of the mounting. The sets of three springs consist of two wound left with one wound right in between them, and are kept apart by the dividing bushes. They are assembled on a springs compressing rod, the front end of which serves as an attachment for the springs assembling apparatus. The adjusting nut is formed with an external shoulder which forms a bearing for a spring compressing plate; the plate supports the front end of a spring. When the gun is vertical there is no muzzle preponderance. As the gun is depressed, muzzle preponderance comes into play, and the compressing rods are drawn to the rear thereby increasing the tension on the springs. The tension on the springs tends to rotate the elevating arc and relieve it of the pressure caused by the preponderance.

**44. Electric installation.**—The electric current is provided from a generating set, or may alternatively come from a mains supply. Various cables are used to convey and distribute the current (Fig. 22). The current is conveyed by cable to a 15-way slip ring in the centre of the platform and from thence by two cables to an A.A. No. 2 gun junction box mounted on two straps secured on the front ends of the chute supporting angles. From the gun junction box, two cables from each side lead to elevating and traversing oil units, respectively. Two cables, one from each side, lead to respective triple pole switches, one controlling the elevating oil unit and the other the traversing oil unit. One cable from the rear leads to a low speed direction indicator mounted on the right rear of the platform.

The electric current is for remote control and enables the gun to be elevated or traversed simultaneously with a predictor.

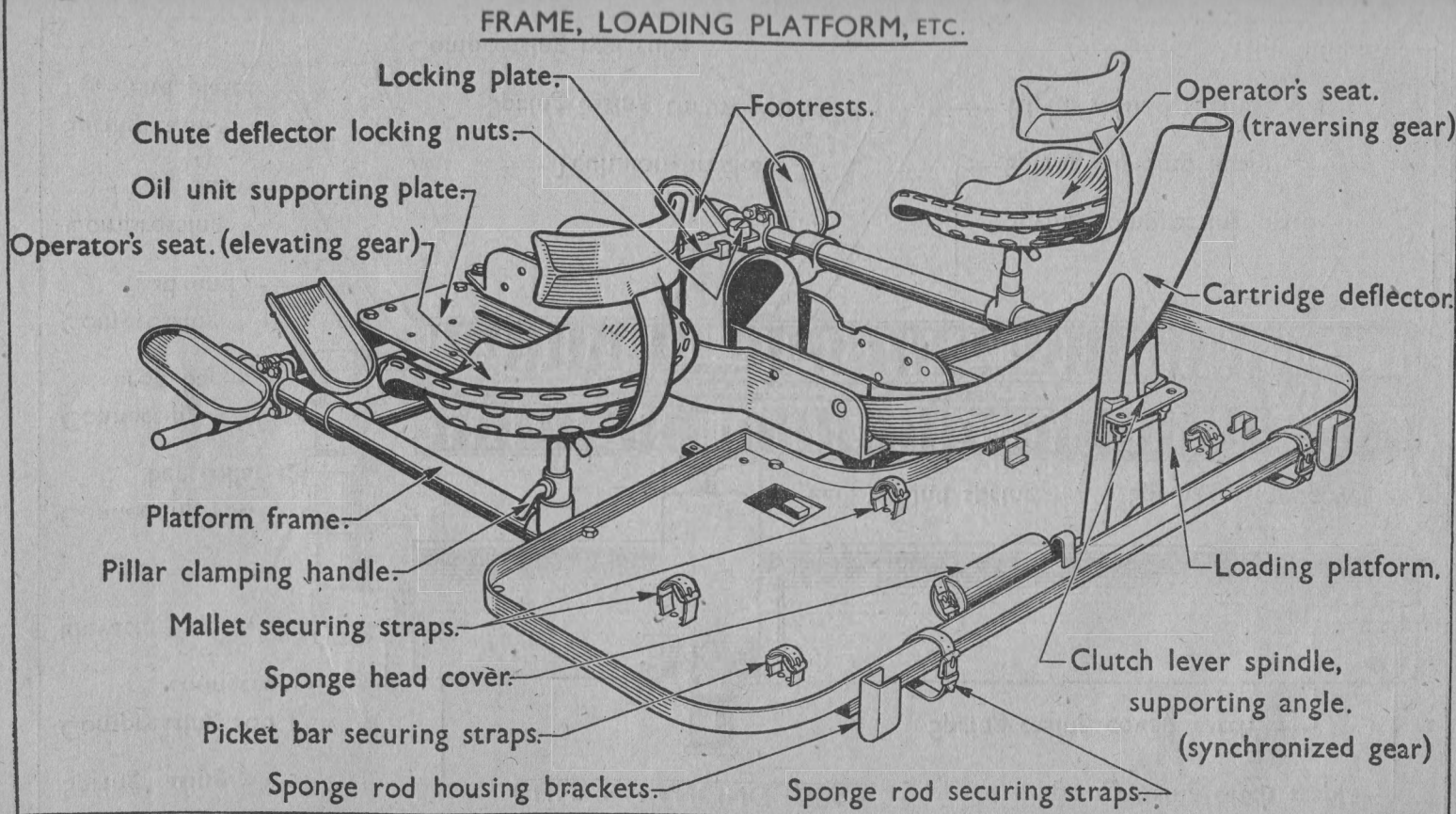


FIG. 20.

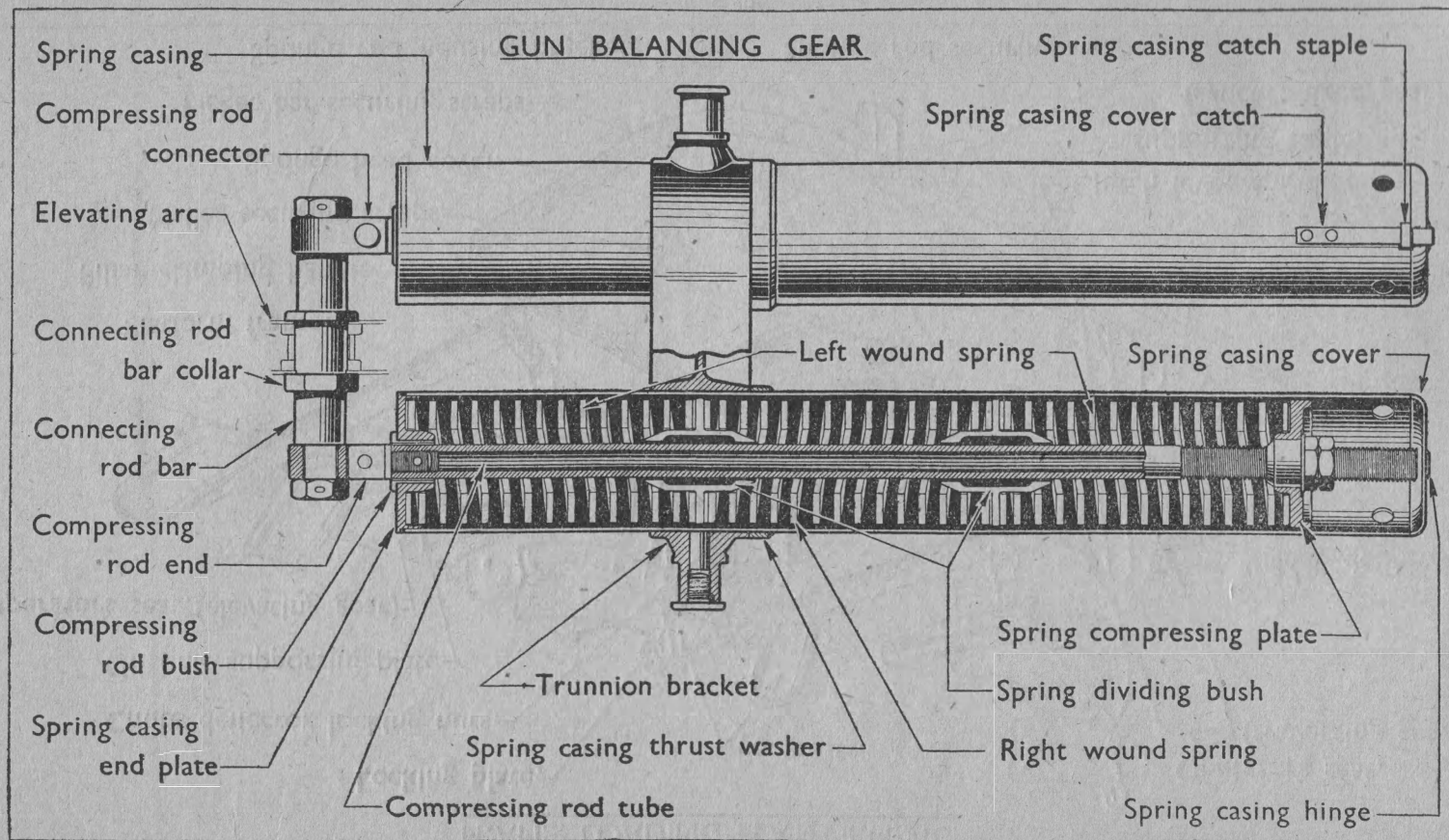


FIG. 21.

CABLE AND TERMINAL MARKINGS

SWITCH,  
-TRIPLE POLE.

INDICATOR,  
LOW SPEED, MK I

SWITCH,  
TRIPLE POLE

Note 1 Cable core numbers are indicated by numbers circled adjacent to terminal—thus 4



# CABLE AND TERMINAL MARKINGS

- Note 1 Cable core numbers are indicated by numbers circled adjacent to terminal—thus 4
- Note 2 Terminal markings in junction box and on sides of slip ring and cable connection plug represent marking on individual terminals of unit to which the individual rings are ultimately connected.
- Note 3 The centre row of numbers on both the slip rings and the cable connection plug is the ring numbering and is given merely for convenience in wiring.
- Note 4 For the three phase supply connected to rings A.B.C. the phase supply sequence must be in this order to ensure correct direction of rotation of the A.C. driving motors.

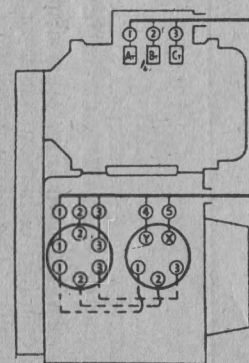
SWITCH,  
-TRIPLE POLE.

INDICATOR,  
LOW SPEED, MK I

SWITCH,  
TRIPLE POLE

## WIRING DIAGRAM

MOTOR, INDUCTION, No 1



OIL-UNIT, TYPE B, MK IV  
(TRAINING)

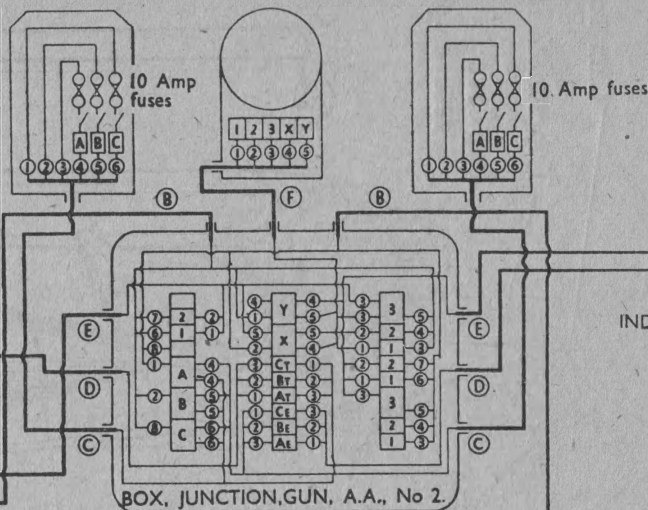
RING, SLIP,  
15 WAY, No 3, MK I

Training

Spare core

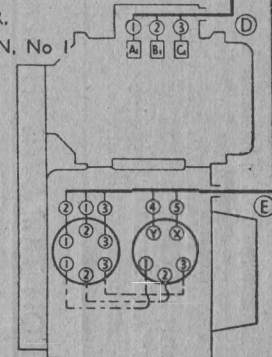
Elevation

BOX, CONNECTOR, A.A., No 3



BOX, JUNCTION, GUN, A.A., No 2.

MOTOR,  
INDUCTION, No 1



OIL-UNIT, TYPE B, MK IV  
(ELEVATION)

See note 3

FIG. 22.

The two triple pole limit switches are fitted to the mounting. One switch is secured by bolts on the right side of the body of the mounting ; it is operated by either one of two cams secured to a bracket on the right trunnion to cut off the electric current at the gun junction box when the gun arrives at 87 degrees elevation or 2 degrees depression. This switch is fitted with a lever that may be operated by hand (Fig. 23). The other switch is secured by bolts to an angle on the chute and deflector supporting angle fitted on the right

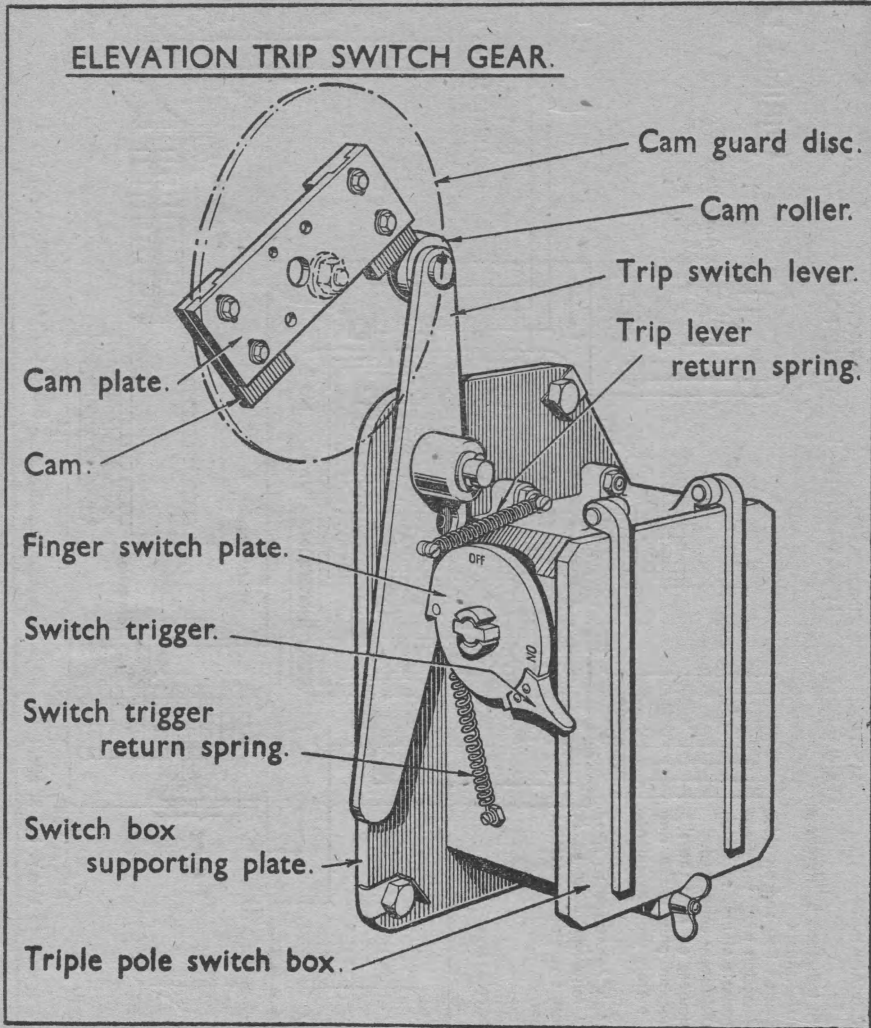


FIG. 23.

side of the platform frame ; it is operated by hand clutch lever of the traversing synchronizing power gear, secured to the chute and deflector stays to cut off the electric current from the traversing unit when necessary.

**45.** The **elevating gear** (Fig. 24) is situated on the left side of the mounting. It can be operated either by power or by hand through the medium of a cranked handle. The elevating oil unit (motor) for power operation is fitted on the left side of the platform frame.

The gear is of the rack and pinion type, incorporating shafts with bevel wheels and pinions driving a worm and worm wheel. The elevating rack or

ELEVATING GEAR.  
(MARK 3 MOUNTING)

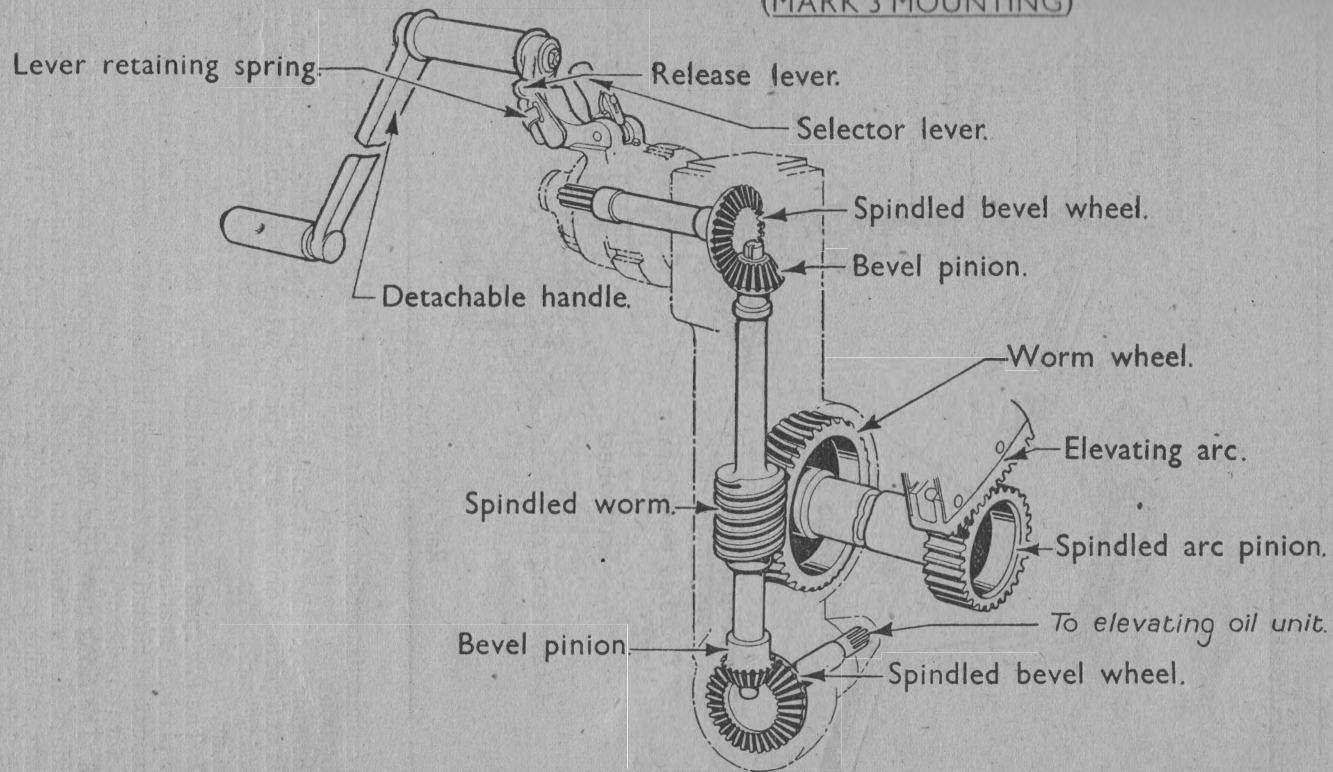


FIG. 24.



arc is secured to the under side of the breech casing. An engaging gear with selector lever is fitted for hand operating.

46. The **traversing gear** (Fig. 25) is situated on the right side of the mounting. It can be operated either by power or by hand through the medium of a cranked handle. The traversing oil unit (motor) (Fig. 18) is fitted on the right side of the platform frame.

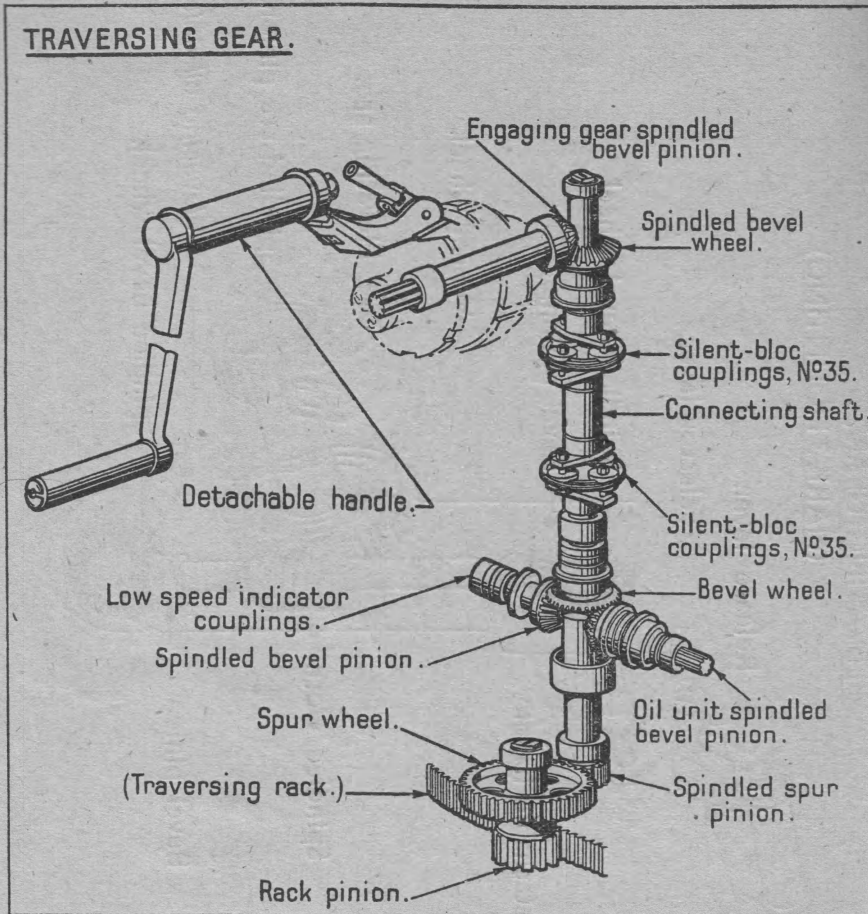


FIG. 25.

A circular traversing rack forms part of the gear and is secured to the box ring by bolts.

The gear is of the rack and pinion type, incorporating shafts with bevel wheels and pinions driving a rack pinion which is in constant mesh with the traversing rack. An engaging gear with selector lever is fitted for hand operating.

47. The **low speed direction indicator** (Fig. 18) is secured to the upper side of the platform near the rear edge on the right side. It indicates the direction the mounting should be traversed to enable the bearings of the gun and predictor to be brought into coincidence.

48. The **firing gear** (Fig. 26) may be operated from two positions on the left side of the mounting, one in front of the layer and the other on the loading platform, a firing pedal is provided for each position. It consists principally of two firing pedals, two crank levers, a firing lever, links, rods and springs.

# FIRING GEAR (Mk.3 Mounting).

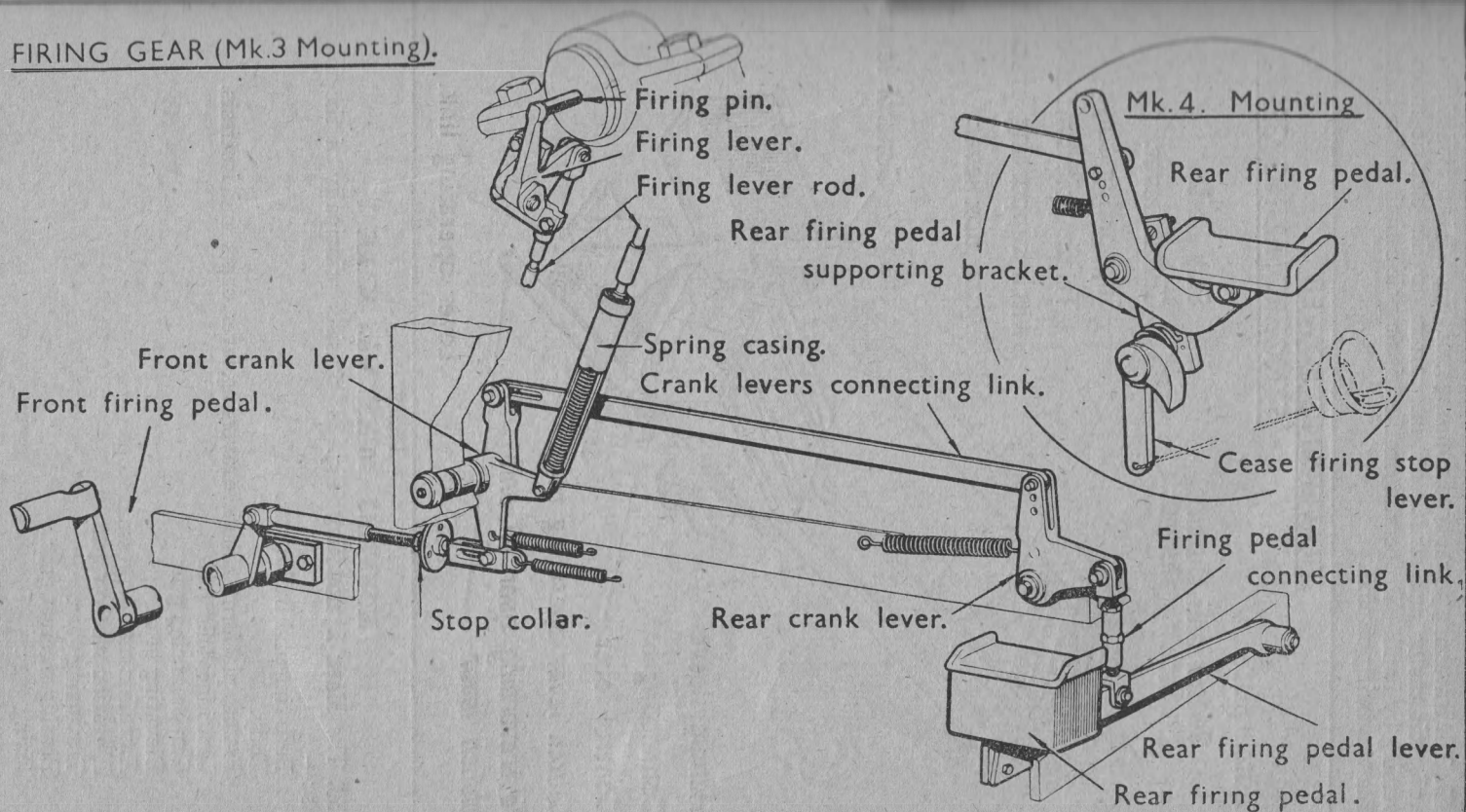


FIG. 26.

49. The **traversing power synchronizing gear** (Fig. 27) is provided to declutch the oil unit motor and switch off the current to the electric motor when traversing by hand. It operates on the tripole pole switch and a clutch lever on the traversing oil unit.

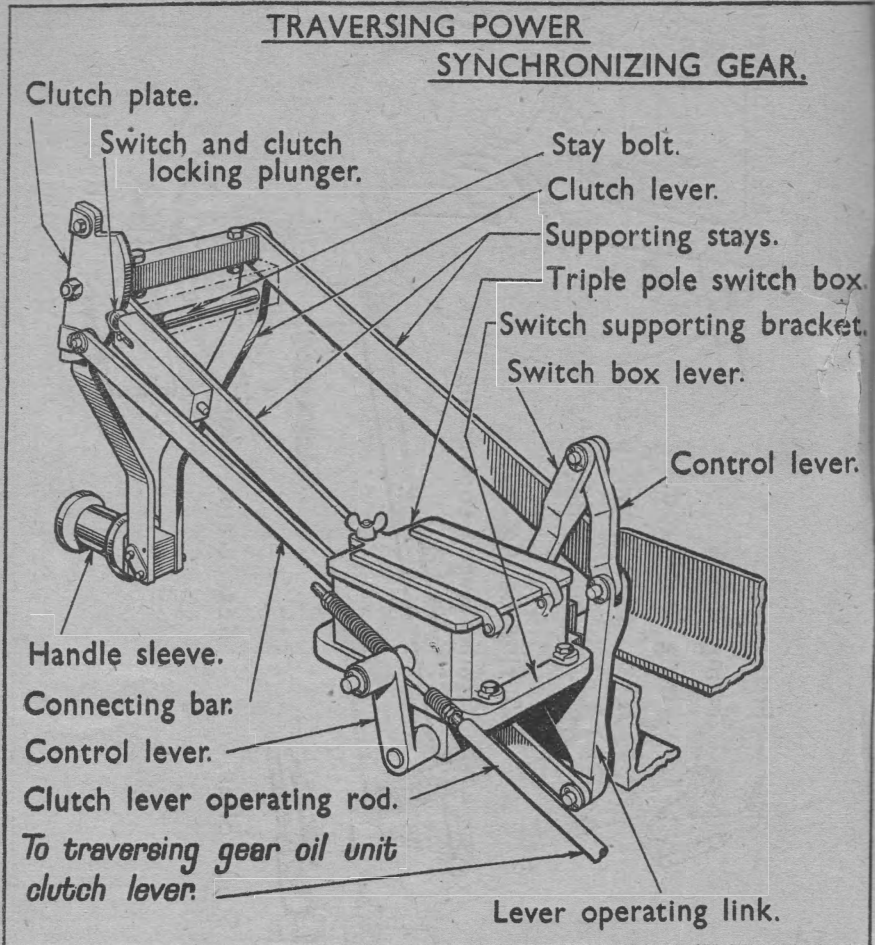


FIG. 27.

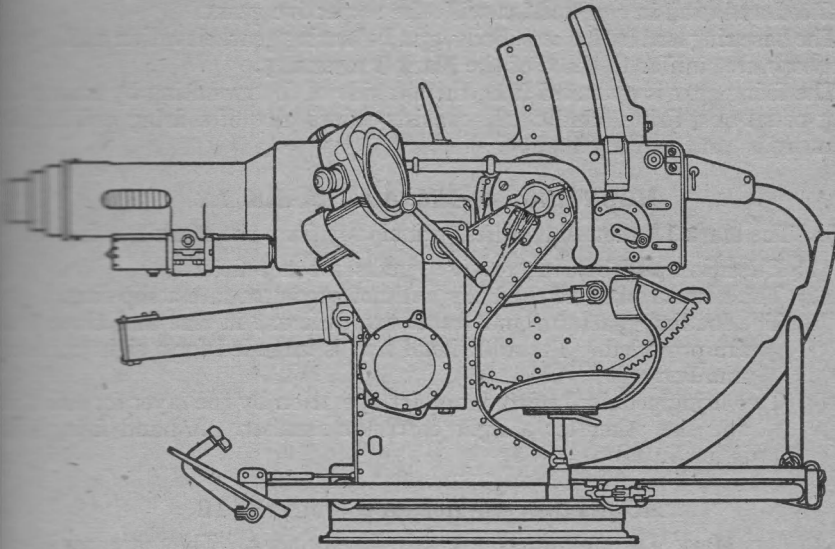
**MOUNTING, 40-MM. A.A., MARK 1**

50. The **Mark 1 mounting** (Fig. 28) consists principally of the following parts:—

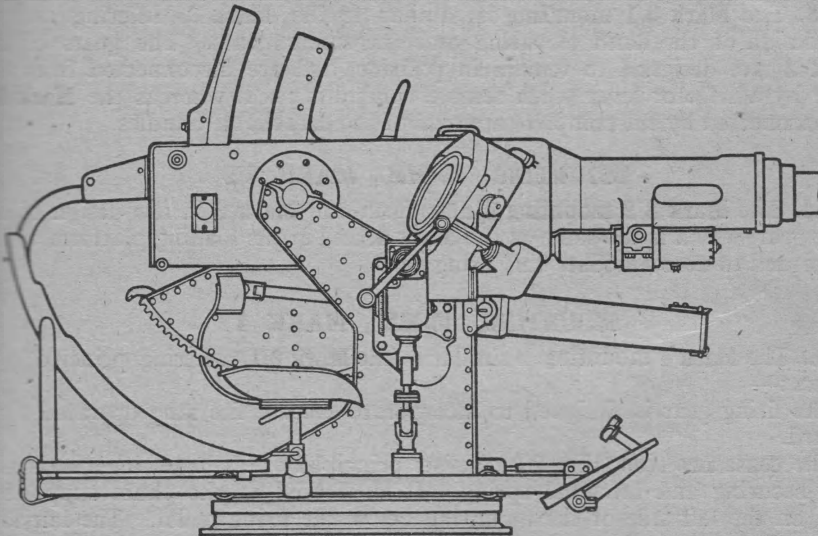
- Base ring and ball racers.
- Body.
- Frame, platform, shields, traversing lever, seats and footrests.
- Cartridge deflector.
- Gun balancing gear.
- Elevating gear.
- Elevation and depression stops.
- Elevation receiver gear.
- Traversing gear.
- Bearing receiver gear.
- Firing gear.



MARK I MOUNTING.  
GENERAL ARRANGEMENT.



Left side elevation.



Right side elevation.

It differs principally from the **Mark 3 mounting** in that it is not power operated, and, in consequence, the elevating and traversing gears are of a different design.

A traversing lever for quick traverse is fitted ; when not in use it is housed in its retaining clip.

An elevation receiver gear (Fig. 29) and a bearing receiver gear (Fig. 30) are fitted and used in conjunction with the respective gears.

The base ring and ball racers, body, gun balancing gear, elevation and depression stops are similar to those of the **Mark 3 mounting**.

The firing gear is operated from the left side of the mounting by means of a firing pedal or a firing handle. It consists principally of a firing pedal, links, levers, rods, and a firing handle.

#### **MOUNTING, 40-MM. A.A., MARK 1A**

51. The **Mark 1A mounting** differs principally from the **Mark 1** as follows :—

- (1) Elevation and bearing receiver gears are not fitted.
- (2) The bottom plate of the body will not accommodate a slip ring.
- (3) The loading platform and frame are different in size and three seats are provided. The additional seat is intended for a sight corrector number.
- (4) Two firing pedals are fitted, one for operation by the layer for elevation and the other for a sight corrector number. A hand firing lever is not fitted.

#### **MOUNTING, 40-MM. A.A., MARK 1B**

52. The **Mark 1B mountings** are two in number. They are registered Nos. 716 and 717. They were originally **Mark 1 mountings**, but are converted to **Mark 1B** by having elevating and traversing gears fitted for hand control and designed so that they may be adapted for power control if required.

#### **MOUNTING, 40-MM. A.A., MARK 3/1**

53. The **Mark 3/1 mounting** is similar to the **Mark 3**, differing only in the design of the hand elevating and traversing gears. The gears of the **Mark 3** are designed to remain in position, and are disconnected from the drive by a selector lever when remote control is used, whereas the **Mark 3A** is disconnected by the complete removal of the detachable handles.

#### **MOUNTING, 40-MM., MARK 3/2**

54. The **Mark 3/2 mounting** differs from the **Mark 3** in the design of the firing gear, which is the same as the **Mark 4**, and in the loading platform which is designed to accommodate this firing gear.

#### **MOUNTING, 40-MM., MARK 4**

55. The **Mark 4 mounting** is similar to the **Mark 3/1**, differing principally as follows :—

The firing gear is designed to incorporate a cease fire stop operated by a lanyard.

The **cease fire stop** (Fig. 26) consists principally of a lever, lever axis pin, plate securing and torsional spring. It is secured to the chute supporting angle on the left side of the mounting below the firing pedal. The lanyard, when pulled, causes the cam part of the lever to make contact with the firing pedal, and prevents it being depressed. The torsional spring, mounted on the lever, returns it to the ready position when the lanyard is released.

ELEVATION GEAR & ELEVATION RECEIVER GEAR

Coupling disc.

# ELEVATION GEAR & ELEVATION RECEIVER GEAR.

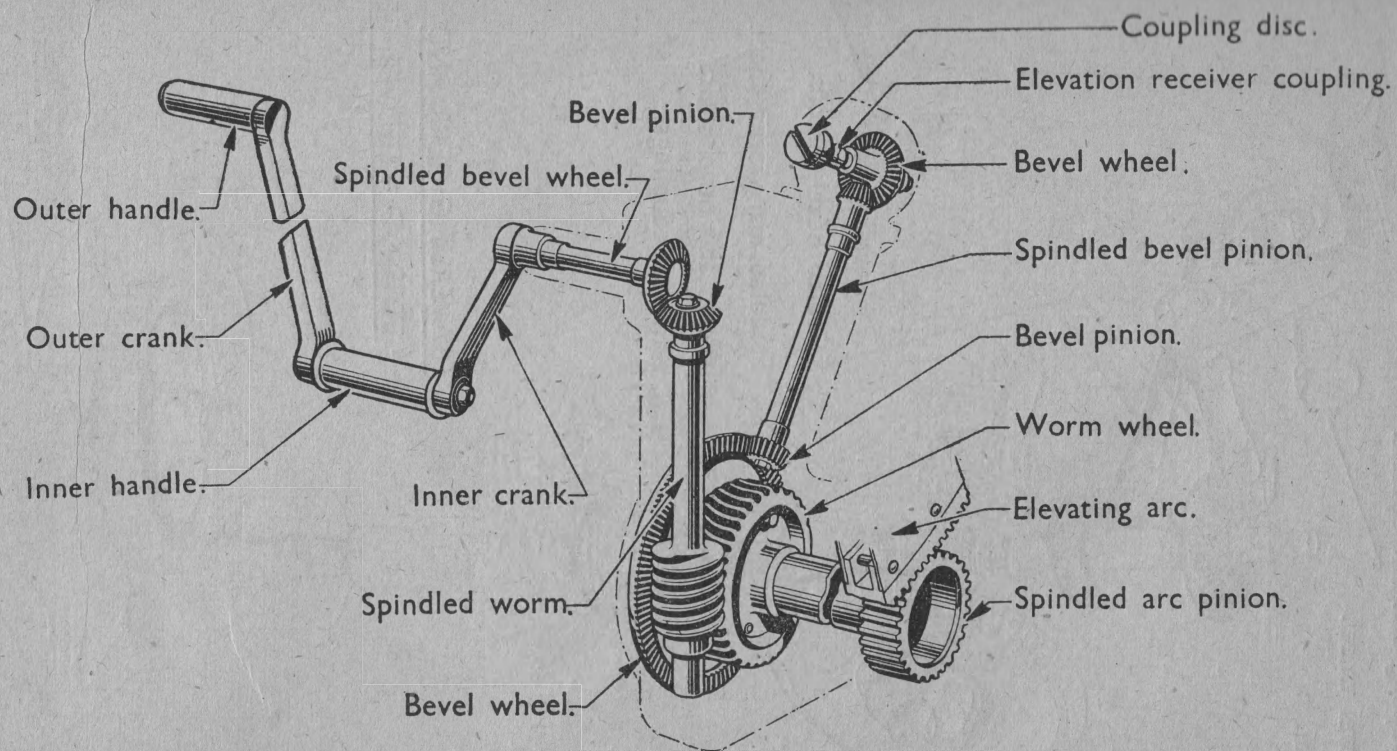


FIG. 29.



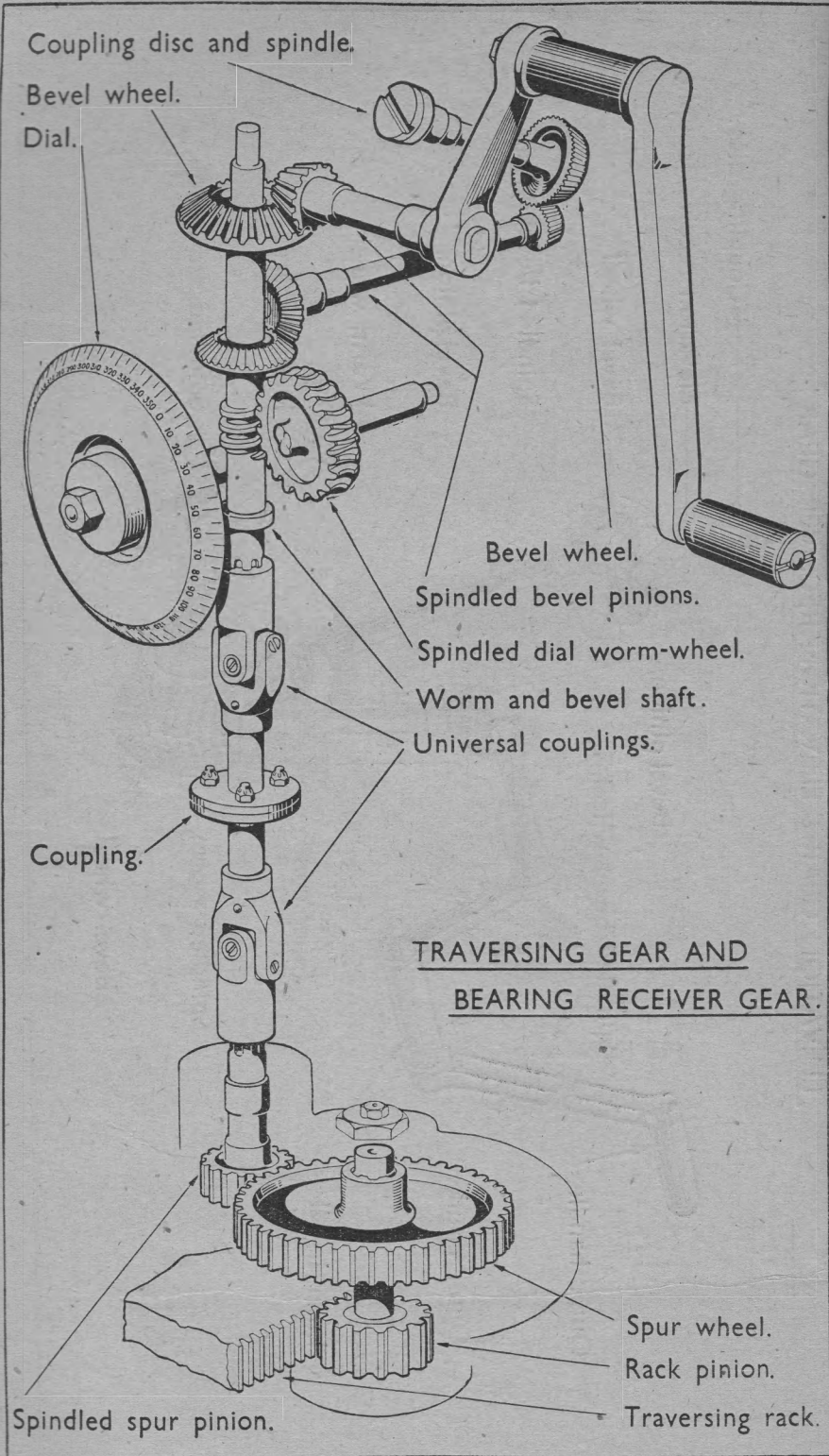


Fig. 30.

# SIGHT BARS, TANGENT ELEVATION & LATERAL DEFLECTION GEARS.

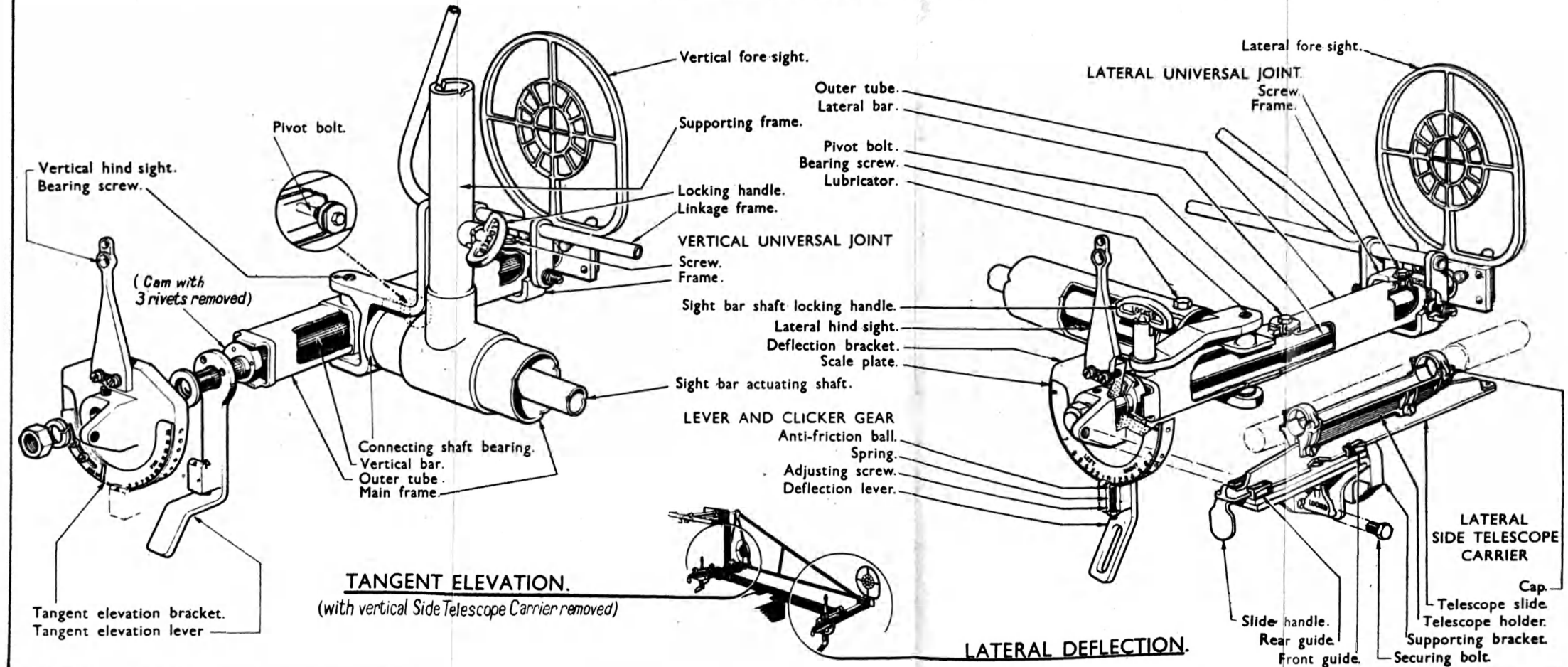
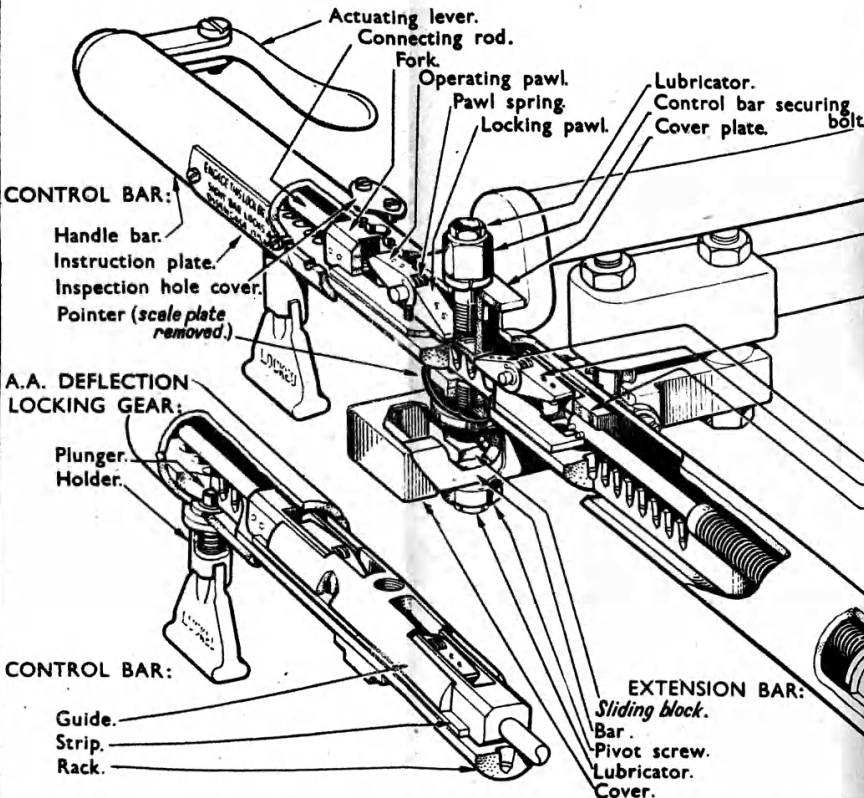


FIG 31

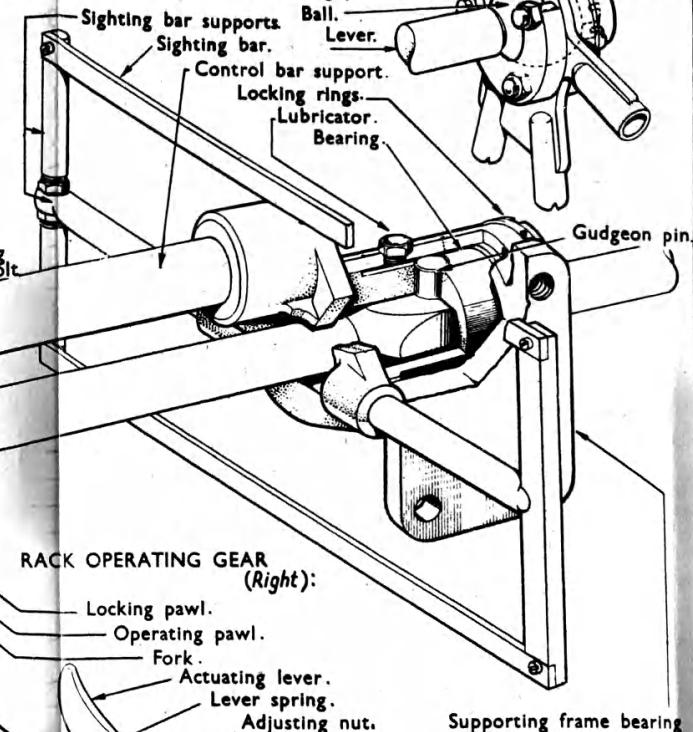
# MARK 5/1 CORRECTIONAL SIGHT.

## CORRECTIONAL HEAD.

### RACK OPERATING GEAR (Left):



### CENTRE HEAD:



### A.A. DEFLECTION OPERATING LEVER:

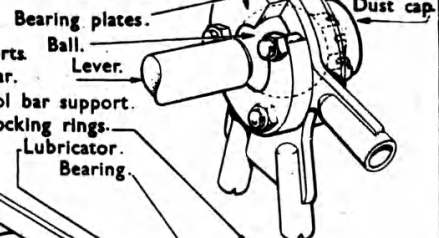


FIG 32



# LIST OF LUBRICATORS

NUMBER ON CHART	POSITION	CODE LETTER
1 to 4	ORDNANCE	T
	Breech casing	
	MOUNTING	
	Body	
5 & 6	Capsquares - Breech casing balancing gear trunnions	B
7 & 8	Capsquares - Breech casing trunnions	B
9	Cross - tube	B
10	Base ring bush (Shown on fig 35)	B
11 to 15	Bottom plate ( " " " " )	B
16	Firing pedal - Firing gear	B
	Traversing gear	
17	Part I - Upper bevel gear case	B
18	End bearing - Upper bevel gear case	B
19 & 20	Part II - Upper bevel gear case	B
21	Part III - Upper bevel gear case	B
22	Dial spindle	B
23	Part I - Lower Spur gear case	B
24	Top cover - Lower spur gear case	B
25	Part II - Lower spur gear case	B
	Elevating gear	
26 to 29	Part I - Worm & bevel gear case	B
30	Lower bearing cap - Part I of worm & bevel gear case	B
31	Part II - Worm & bevel gear case	B
32	Part III - Worm & bevel gear case	B
33	Cover cap of Part III - Worm & bevel gear case	B

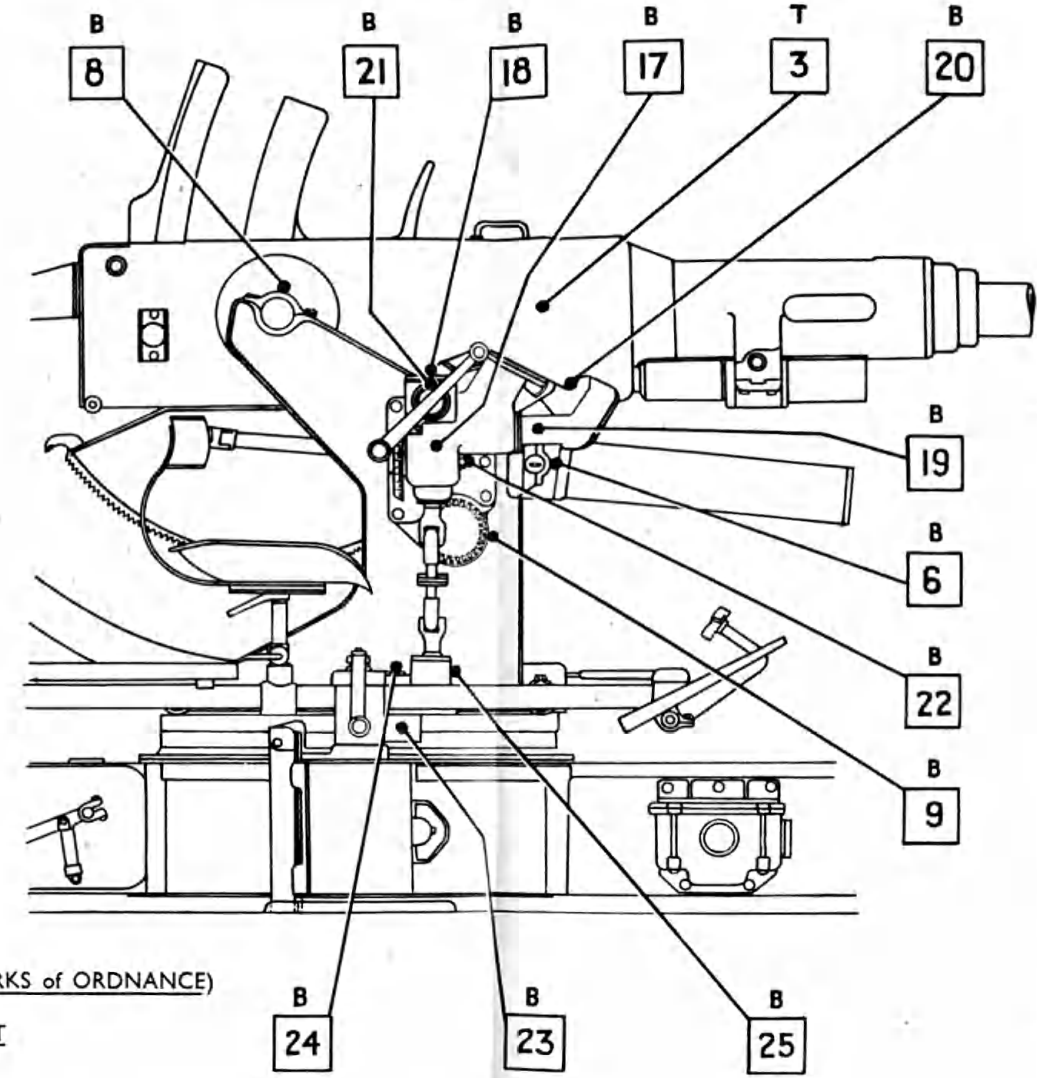
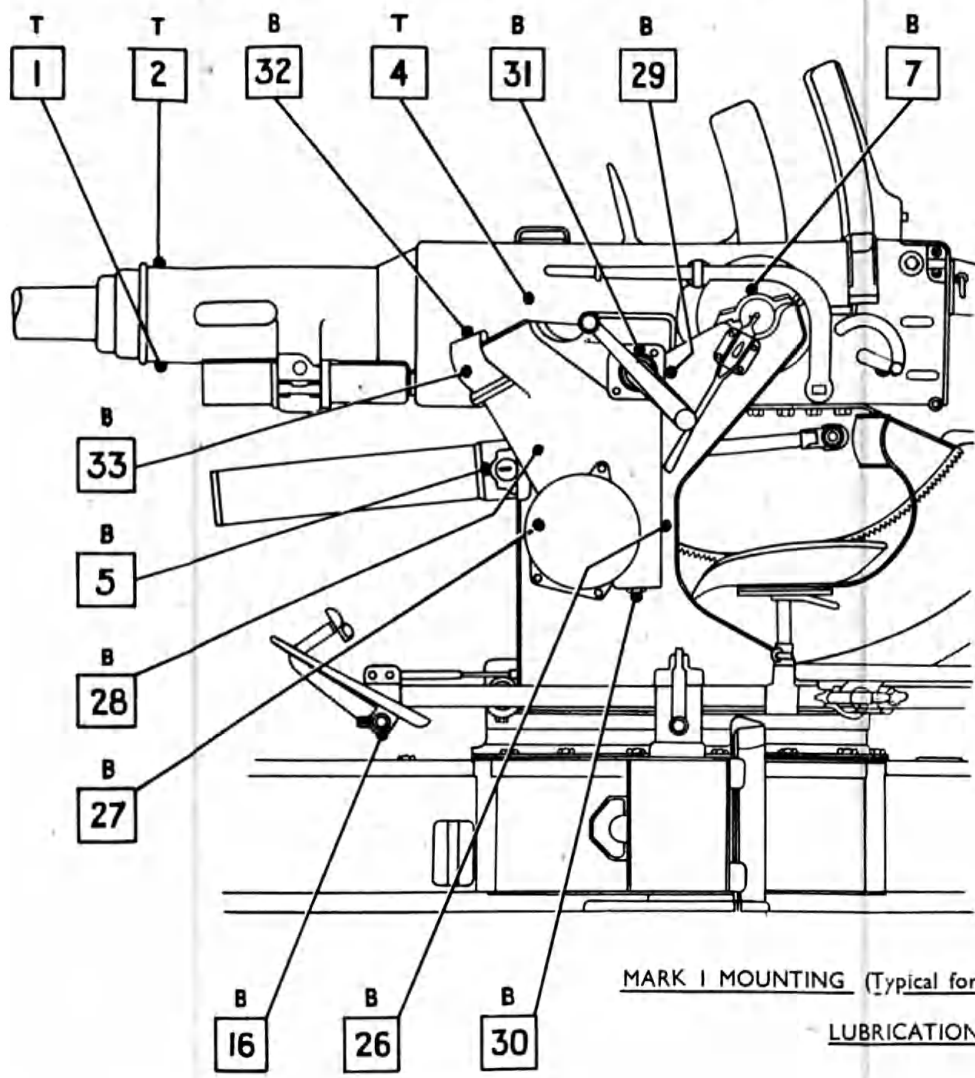
CODE LETTER KEY

Oil C. 600.....B

Mixture by volume - 10 parts Oil, C 600 to 1 part Oil, graphited concentrate.....T

NOTE

These lubricants are for use under normal conditions. Alternatives for abnormal conditions are given in paragraph 77.



MARK I MOUNTING (Typical for all MARKS of ORDNANCE)

LUBRICATION CHART

FIG. 33.

# MARK 3 MOUNTING (Typical for MARK 4).

## LUBRICATION CHART

### LIST OF LUBRICATORS

NUMBER ON CHART	POSITION	CODE LETTER
1 & 2	Body	
3 & 4	Capsquares - Breech casing balancing gear trunnions	B
5	Capsquares - Breech casing trunnions	B
6	Cross - Tube	B
7 to 10	Base ring bush	B
11	Bottom plate	B
	Firing pedal	B
	Traversing gear	
12	Top cover - Large bevel gear case	B
13	End bearing - Small bevel gear case	B
14 & 15	Spur gear case	B
16	Engaging gear bearing - Hand traversing gear	B
17	Oil plug - Large bevel gear case	H
18	Bearing of control lever - Synchronizing gear	B
	Elevating gear	
19	Worm & Bevel gear case	B
20	Engaging gear bearing - Hand elevating gear	B
21	Oil plug - Worm wheel cover	H

In addition to the foregoing, all working parts, e.g. joints of levers, catches etc. (where lubricating holes are not provided), should be occasionally oiled.

### CODE LETTER KEY

Oil C. 600.....B  
Oil 10. H.D.....H

### NOTE

These lubricants are for use under normal conditions. Alternatives for abnormal conditions are given in paragraph 77.

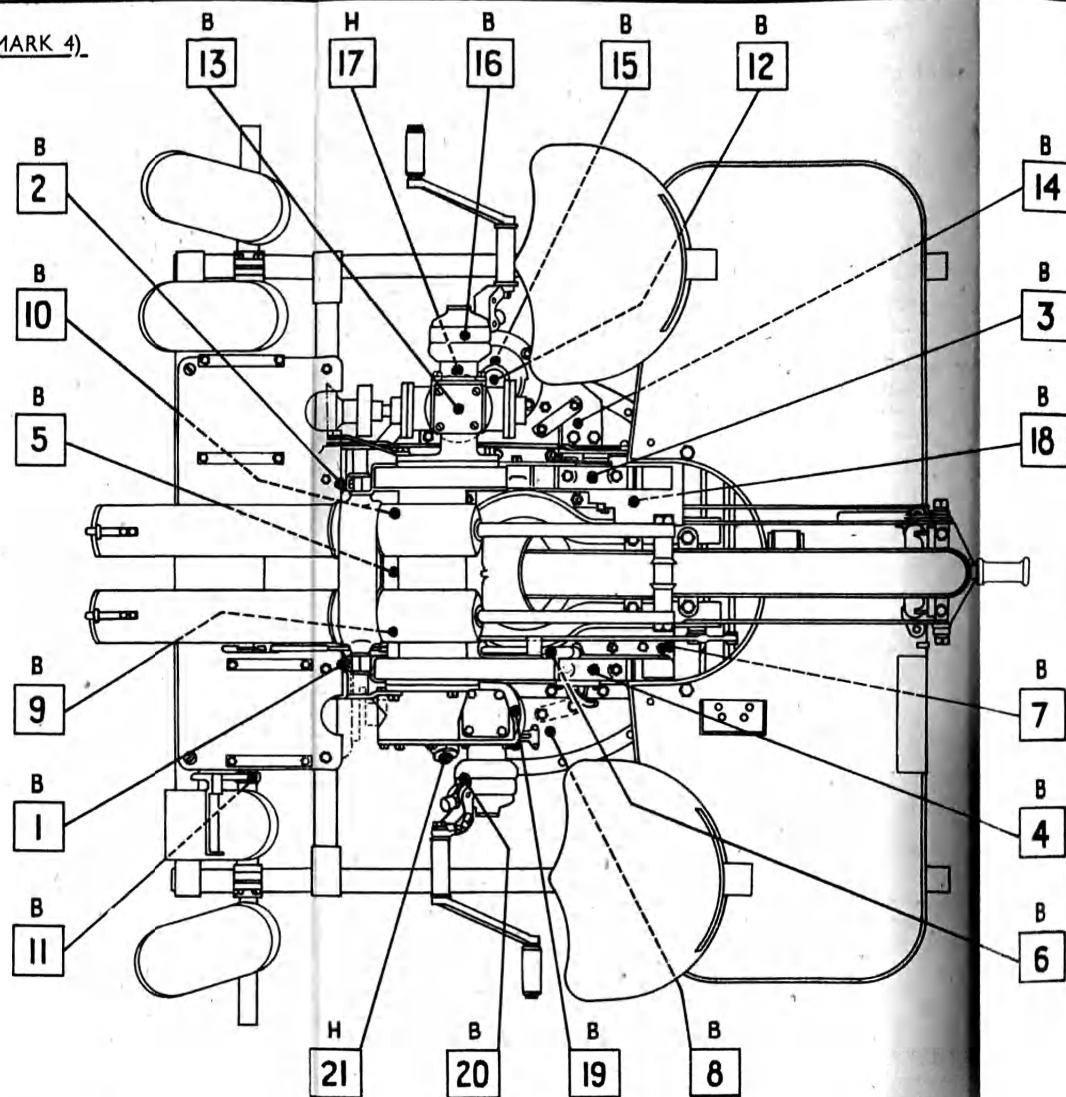


FIG. 34.

# LIST OF LUBRICATORS

NUMBER ON CHART	POSITION	CODE LETTER	NUMBER ON CHART	POSITION	CODE LETTER
34 to 37	No.222 Special axletree. (Front)	B	88	Rear axle balancing gear	B
*38 & 39	Axletree bar	B	89	Toothed arc cover	B
40 to 43	Spring compressing rods	B	+90	Locking arc plunger	B
44 to 51	Stub axle and Shackles cross-heads	B	91 to 99	Long chain link pin	B
52 to 55	Lower shackles	B	100 to 103	Steering gear	B
	Upper shackles	B	104 to 107	No.15, No.28. Anti - friction hubs	N
			108 to 111	Levelling screw jacks	B
56 to 59	No.223 Special axletree (Rear)	B	108 to 111	Gun stay	B
*60 & 61	Axletree bar	B	* Accessible after removal of plugs. † Accessible after removal of plugs, the wheels being turned towards the firing position.  Wheel hubs, numbers 100 to 103 to be maintained 2/3 full of grease.  In addition to the foregoing, all working parts, e.g. joints of levers, catches etc. (where lubricating holes are not provided), should be occasionally oiled.		
62 to 69	Spring compressing rods	B			
70 to 73	Lower shackles	B			
	Upper shackles	B			
74	No.30 Draught connector	B	<b>CODE LETTER KEY</b> Oil C. 600.....B Grease, G.S.....N		
75	Connecting hinge bolt	B			
	Inner tube	B	<b>NOTE</b> These lubricants are for use under normal conditions. Alternatives for abnormal conditions are given in paragraph 77.		
76 & 77	Frame - Swivelling head	B			
	Capsquares - Axletree bearing brackets	B			
78 & 79	Frame - Longitudinal girder	B			
	Capsquares - Axletree bearing brackets	B			
80 to 83	Frame - Left and right outer girders	B			
	Hinge joint	B			
84 & 85	Front axle balancing gear	B			
+86	Outer front bearing	B			
87	Spring compressing rod connecting pin	B			
	Locking arc plunger	B			

## MARK I PLATFORM LUBRICATION CHART

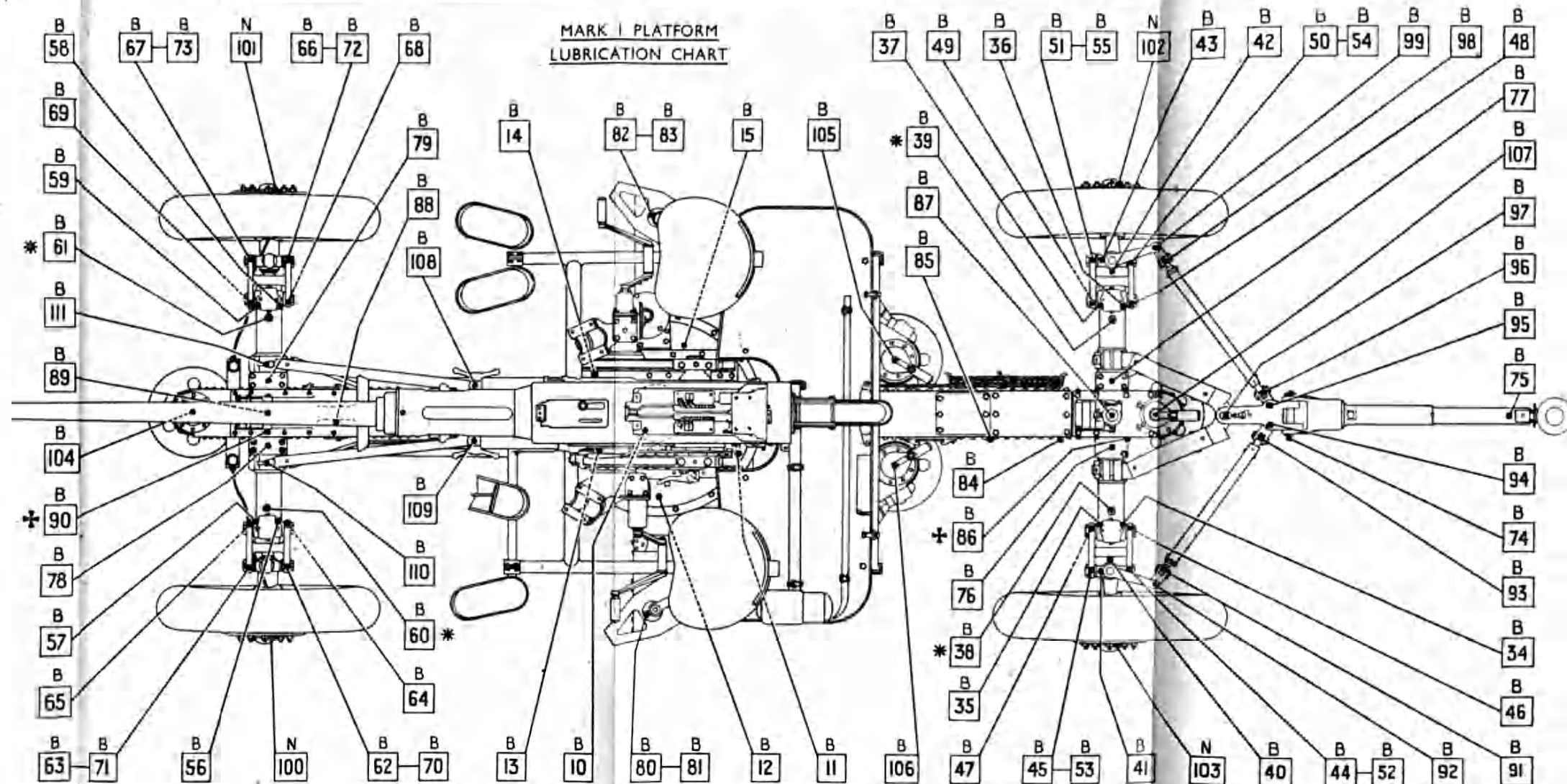


FIG.35.



# LIST OF LUBRICATORS

NUMBER ON CHART	POSITION	CODE LETTER
1 & 2	Bearing pins	B
3 & 4	Locking clamp	B
5 to 8	Levelling screw jacks	B
9 to 11	Actuating screws	B
12	Front axle bearing and locking gear	B
13	Steering head	B
	Swivel pin	B
	Draught connector	B
	Eye block	B

In addition to the foregoing, all working parts, e.g. joints of levers, catches etc. (where lubricating holes are not provided), should be occasionally oiled. Wheel hubs to be packed with mineral jelly - inspect periodically.

## CODE LETTER KEY

Oil C. 600.....B

## NOTE

These lubricants are for use under normal conditions. Alternatives for abnormal conditions are given in paragraph 77.

## MARK 2 PLATFORM LUBRICATION CHART

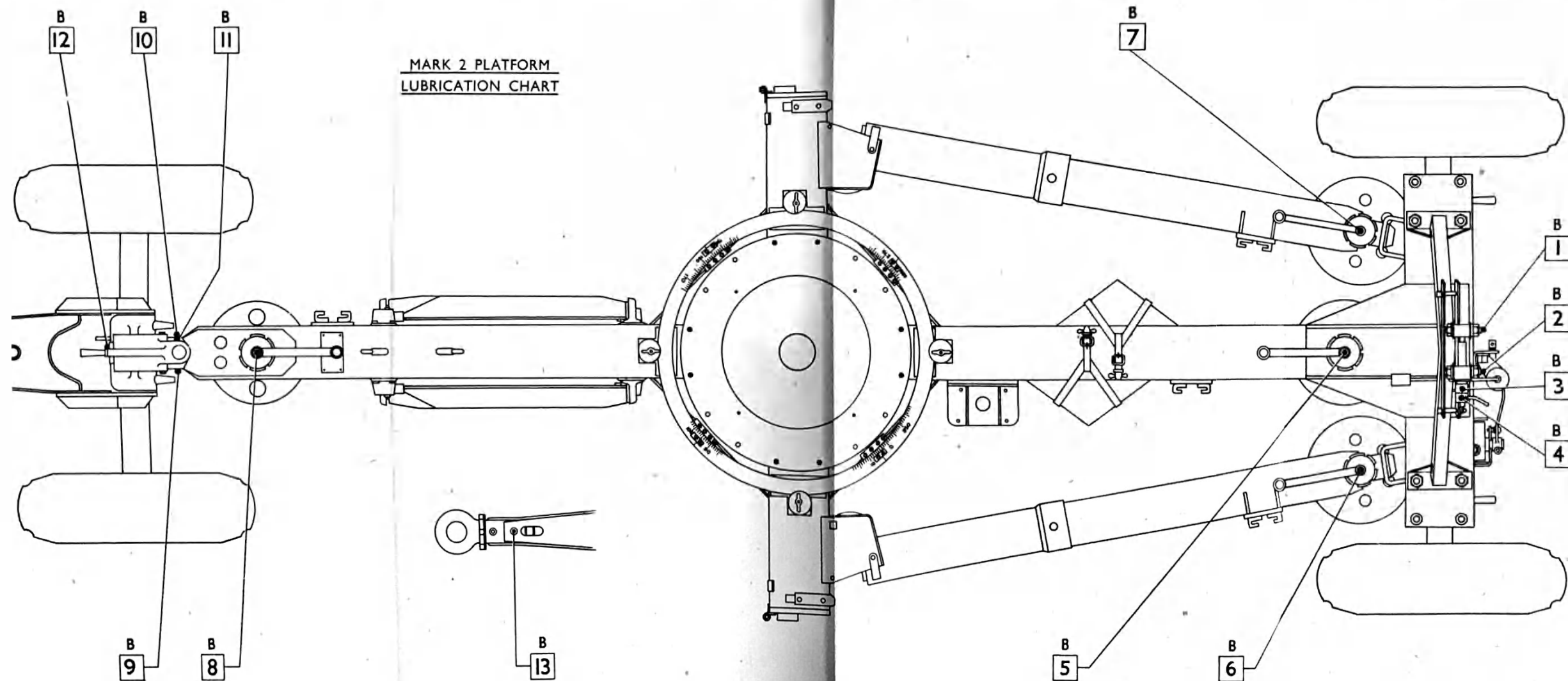


FIG. 36.

The traversing gear differs in the design of the low speed indicator coupling and bevel pinion.

The power-traversing synchronizing gear differs from the **Mark 3/1** in that a supporting stay is removed, and a distance washer is fitted to the handle spindle of the clutch lever.

The loading platform and frame differ in that the frame is of modified design and the loading platform consists of two plates, the larger of which is to the left of the mounting, and affords greater accommodation for the loading members.

In future manufacture, the cross tube on the right of the body will be blanked off with a cover and the words "block and closing plate" dispensed with.

56.

### LIST OF MOUNTINGS, WITH OLD AND NEW MARKS

Original Mark.	New Mark.	Remarks.
Mounting, 40-mm. A.A., Mark 1 ..	1	
Mounting, 40-mm. A.A., Mark 3 ..	3	
Mounting, 40-mm. A.A., Mark 3A ..	3/1	Basic Mark 3 with detachable handles in lieu of selector type.
Mounting, 40-mm. A.A., Mark 3B ..	3/2	Basic Mark 3 with Mark A type firing gear and a modified platform.
Mounting, 40-mm. A.A., Mark 3/H.S...	3/3	Basic Mark 3 with high speed 17-degrees 9-minutes hand traversing.
Mounting, 40-mm. A.A., Mark 3A/H.S.	3/4	Mark 3A with high speed 17-degrees 9-minutes hand traversing.
Mounting, 40-mm. A.A., Mark 3B/H.S.	3/5	Mark 3B with high speed 17-degrees 9-minutes hand traversing.
Mounting, 40-mm. A.A., Mark 3/I.S...	3/6	Basic Mark 3 with intermediate speed 13-degrees 8½-minutes hand traversing.
Mounting, 40-mm. A.A., Mark 3A/I.S.	3/7	Mark 3A with intermediate speed 13-degrees 8½-minutes hand traversing.
Mounting, 40-mm. A.A., Mark 3B/I.S.	3/8	Mark 3B with intermediate speed 13-degrees 8½-minutes hand traversing.
Mounting, 40-mm. A.A., Mark 4 ..	4	As against Mark 3, differences are :— Detachable handles, modified firing gear, modified platform and frame, synchronizing gear and low speed indicator coupling.
Mounting, 40-mm. A.A., Mark 4/H.S.	4/1	Basic Mark 4 with high speed 17-degrees 9-minutes hand traversing.
Mounting, 40-mm. A.A., Mark 4/I.S...	4/2	Basic Mark 4 with intermediate speed 13-degrees 8½-minutes hand traversing.

LIST OF MOUNTINGS, WITH OLD AND NEW MARKS—*continued*

Original Mark.	New Mark.	Remarks.
Mounting, 40-mm. A.A., Mark 5 ..	5	S.P. Vehicle (Morris Carrier).
Mounting, 40-mm. A.A., Mark 5/1 ..	5/1	Basic Mark 5 with power control removed.
Mounting, 40-mm. A.A., Mark 5/I.S. . .	5/3	Basic Mark 5 with intermediate speed 13-degrees 8½-minutes, hand traversing.
Mounting, 40-mm. A.A., Mark 5/1/I.S.	5/4	Mark 5/1 with intermediate speed 13-degrees 8½-minutes hand traversing.
Mounting, 40-mm. A.A., Mark 7 ..	7	Basic Mark 3 converted for India.
Mounting, 40-mm. A.A., Mark 8 ..	8	Basic Mark 4 converted for India.
Mounting, 40-mm. A.A., Mark 9 ..	9	Basic Mark 3 converted for Bantam Equipment.
Mounting, 40-mm. A.A., Mark 10 ..	10	Basic Mark 4 converted for Bantam Equipment.

## Sighting

**57. Sights, Correctional, 40-mm. A.A. Mounting, Mark 5/1.**—The Mark 5/1 correctional sight (Figs. 31 and 32) consists principally of a main frame, correctional head, A.A. deflection operating gear, lateral and vertical side sight bars, linkage frame, lateral deflection gear and tangent elevation gear.

The **main frame** is secured to the breech casing and carries the whole of the sighting gear. It is tubular, and forms a bearing for the sight bar actuating shaft, to the ends of which are pivoted the outer tubes of the lateral deflection and T.E. sight bars. Telescope carriers are mounted on supporting brackets secured to the sight bars. A vertical arm on the main frame is prepared at its upper end as a support for a bearing to carry the correctional head. Supporting bars projecting from this bearing carry two sighting bars.

The **correctional head** comprises a control bar with rack, right and left rack operating gears, and A.A. deflection operating lever with extension bar. The control bar is attached to a support, the other end of which is secured to the correctional head bearing. The deflection operating lever has its rear end secured to the extension bar, which is pivoted to the rack. The front end of the operating lever is secured to the linkage frame through the medium of a ball joint.

The **linkage frame** couples the lateral and vertical side bar outer tubes through universal joints, and connects them to the A.A. deflection operating lever through the ball joint.

The **lateral deflection and T.E. sight bars** are housed in outer tubes, the deflection sight bar being pivoted on a vertical pivot and the T.E. sight bar on a horizontal pivot pin. This arrangement permits lateral deflections and T.E. to be applied to the appropriate sight bars when their outer tubes have been locked, as described later. Each sight bar is fitted with a fore and a hind sight. Each hind sight is provided with two apertures, the upper one being to enable additional T.E. to be applied for long range harassing fire. Sliding telescope

carriers  
deflectio  
from 0  
gear an  
yards.  
Lock  
provide

The  
a modi  
Two ac  
the pay  
The  
sighting

**58.**  
gear  
assesse  
right  
move  
longer  
lated s  
fuselag  
sight l  
so tha  
A.A. c  
Wl  
plunge  
tion i  
horizo  
eccent  
left.  
deflec  
operat  
the sig  
the la

**59**  
manu  
with  
indica  
Ce  
both  
TL  
The  
divisi  
is div  
(SO



carriers are mounted on brackets secured to the sight bars. The lateral deflection sight bar has a lever and clicker gear, and a scale plate graduated from 0·8 right and left. The T.E. sight bar is provided with a lever and clicker gear and a scale plate graduated in steps of 200 yards from 300 yards to 2,300 yards.

Locking devices consisting of spring-loaded plungers with handles are provided as follows:—

Two plungers to lock the sight bar outer tubes to the main frame.

One plunger in the correctional head control bar to lock the A.A. deflection gear by preventing movement of the rack.

Two plungers to lock the sliding telescope carriers when the telescopes are not in use.

NOTE.—It is most important that the A.A. deflection locking plunger in the correctional head be engaged before, and disengaged after, the sight bar locking plungers. Failure to observe this precaution may result in damage to the rack operating gear.

The **Mark 5/1** correctional sight differs from the **Mark 5** by being fitted with a modified correctional head which gives positive locking at all speed settings. Two access holes, with covers, have been provided to facilitate withdrawal of the pawls.

The sighting telescopes used with this equipment are the Telescope, sighting, No. 22C, Marks 2 and 3, and No. 22D, Mark 1.

**58. Action of the sights.**—When used in the A.A. rôle, the A.A. deflection gear and sight bar plungers are disengaged. "Aim-off" deflections are assessed and applied on the correctional head by operating either the left or right actuating levers. Operation of one of these levers causes the rack to move in the direction of that lever, which is therefore displaced so that it is no longer parallel to the correctional head support. The control bar is manipulated so that one of the sighting bars of the correctional head is laid along the fuselage of the target. This automatically applies the A.A. deflection to the sight bars through the operating lever, linkage frame and sight bar outer tubes so that the action of laying the sights on the target gives the gun the required A.A. deflection.

When used in the anti-tank rôle, the A.A. deflection gear and sight bar plungers are first engaged so as to lock the A.A. deflection gear. Lateral deflection is applied direct to the lateral deflection sight bar which pivots horizontally in its outer tube. Movement of the deflection gear lever causes an eccentric bush to rotate and swing the rear end of the sight bar to the right or left. By aligning his sights on the target, the layer applies the required deflection to the gun. Tangent elevation is applied to the T.E. sight bar by operating the lever, thus turning an eccentric bush and raising the rear end of the sight bar about its pivot in the outer tube. By laying his sight on the target the layer applies the required tangent elevation to the gun.

**59. Drums, indicator, bearing, and Drums, indicator, range.**—In future manufacture, Mountings 40 mm. A.A., Marks 3/6, 3/7, 3/8 and 4/2 will be fitted with a Drum, indicator, bearing to the Hand Traversing Gear, and a Drum, indicator, range to the Hand Elevating Gear.

Certain equipments of the above Marks will be found already fitted with both the Bearing and Range Drums.

The Drum, indicator, bearing, consists of steel inner and outer drums. The outer drum, whose circumference is 24·36 in., is divided into 13 major divisions, each of 1·8739 in. (6·5 degrees right and left), and each major division is divided into 10 minor divisions, each of 0·1874 in. The inner drum is plain.

The Drum, indicator, range, consists of steel inner and outer drums. The inner drum, whose circumference is 23.375 in., is divided into four major divisions, each of 5.844 in., and each major division is divided into 12 minor divisions of 0.487 in. and engraved up to 2 degrees depression and 2 degrees elevation. The outer drum is graduated right-handed from zero to 4,000 yards and engraved in black, and graduated left-handed from 4,000 yards to 5,600 yards and engraved in red.

### SECTION 3

#### GENERAL INSTRUCTIONS ON MAINTENANCE AND TASK TABLES

**60. Maintenance records, i.e.,** Memorandum of examination and gun record book (C.I.A. form 472A), carriage history sheets and recoil history sheets will be carefully maintained and preserved, and will accompany the store on return to R.A.O.C. on transfer to another unit or dispatch to R.E.M.E. for overhaul or repair.

**61. Light preservation** of equipment must be carried out when it is returned to R.A.O.C. or handed over to another unit or dispatched to R.E.M.E. It will be treated as laid down in the lubricant table in Section 4 of this Manual.

**62. Breech fittings** should be frequently taken apart and examined to ascertain that they are sound and in proper working order. They should be treated with care, violence and jerks being avoided and no unnecessary force employed.

All spare parts should be tested for interchangeability as soon as possible after receipt.

Working surfaces and mechanisms should be well lubricated, work easily, and be free from burrs, which, should they occur, must be removed by a qualified artificer.

**63. Barrels** will be removed once each month when equipments are not in use, and every day as far as practicable when firing has taken place. After removal, the bores, surfaces and threads will be cleaned, particular attention being paid to the removal of rust or grit. Before assembly, the exterior of the barrel will be cleaned with an oily rag, and it will be ascertained that the threads in the breech ring are clean.

The threads on the barrel and in the breech ring will be lubricated with graphited grease.

**NOTE.**—Special care must be taken to ensure that any sand, grit or foreign matter is removed from the threads of the breech ring and breech end of the barrel before assembly. Failure to observe this instruction will result in the threads being badly burred or torn.

The breech casing top cover, which is opened when dismantling the barrel, must in no circumstances be closed until the barrel is again in position. Failure to observe this may cause displacement of, and damage to, the breech ring and automatic loader.

**64. If a flaw or a crack** is observed in a barrel, or a similar defect in any part of the mechanism, the spare barrel or spare part will be taken into use and the defective barrel or part examined by the E.M.E.

**65. Clinometer planes** will not be cleaned by the use of brickdust or any abrasive material. Any rust on the plane may be loosened by kerosene and rubbed off with rag or cotton waste.

**66. Before firing,** the bore will be thoroughly wiped out to ensure that it is clean and dry. This is important. Serious damage can occur if firing takes place whilst the bore is heavily oiled or greased.

At 1  
washed  
It shou  
dirty, i  
and oil

67.

68.

69.

protec  
Elevat  
to pre

70

follow

Colo  
Cod

No co

Car  
sho  
liqu  
exc

in  
the  
Lic  
em

th

fu  
or  
a

o  
a  
7  
c

At the end of each day's firing the bore will be, if possible, thoroughly washed out with hot water and the gun depressed to the horizontal position. It should then be dried and, when cool, well oiled. Should the bore be very dirty, it may be cleaned out with paraffin, after which it should be wiped dry and oiled.

**67. Soda** in any form must on no account be used for cleaning the bore.

**68. Guns when not in use** should have their covers in position.

**69. Protection against frost.**—During severe cold weather, buffers should be protected as much as possible to prevent the liquid becoming frozen. Elevating or depressing, or pulling the barrel back in the breech casing, tends to prevent the liquid freezing.

**70. The correct liquid** for use in the buffer at various temperatures is as follows :—

Colour Code.	Use.	Liquids to be used for Temperatures.		
		150° F. to 40° F.	40° F. to 0° F.	0° F. to — 50° F.
No colour	In buffers, recuperators of all types and Marks of 40-mm A.A.	Oil, mineral, hydraulic buffer (C.S. 1117B)	Oil, mineral, hydraulic buffer (C.S. 1117B)	0°–20° F. Oil, mineral, hyd. buffer (C.S. 1117B) Below — 20° F. Mixture of :— 2 parts—oil, min. hyd. buffer (C.S. 1117B). 1 part—white spirit.

Care of liquid is very important. The liquid to be used in the recoil system should be strained to exclude foreign matter. The presence of water in the liquid will seriously affect the system, therefore every effort must be made to exclude moisture.

Liquids should be allowed to stand as long as possible before being used, in order that foreign matter may settle to the bottom. For the same reason, the liquid should not be stirred, nor should the container be entirely emptied. Liquid emptied from the recoil system should not be used again except in an emergency.

#### The Recoil System

**71. The recoil system** comprises a hydraulic buffer and spring recuperator.

Many considerations affect the correct working of the system. Broadly, these may be grouped under three headings :—

- (1) The correct filling of the buffer.
- (2) Packings.
- (3) The careful observation of the system both in and out of action.

The **normal working recoil length** is 205 mm.  $\pm$  20 mm. The "cease fire" order should therefore be given if the length of recoil exceeds 225 mm. ; on the other hand, at lengths of recoil below 185 mm. effective working of the automatic loader is uncertain.

**72. Control of run-out.**—The run-out of the barrel has an important bearing on the steadiness and service of the equipment ; a violent run-out would cause a shock to the mounting and a sluggish run-out means a slower rate of fire. The action is controlled by the non-return and run-out adjusting valves on the control rod.



**73. Packings.**—Packings are provided at the rear end of the buffer cylinder and on the run-out adjusting valve.

Before taking fresh packings into use, they should be carefully examined to see that they are in a fully serviceable condition. They should be perfectly smooth and sharp at the edges, not perished, and free from grit, flaws or cuts. Care must be taken during assembly to avoid damage and to ensure that they are evenly embedded in their supporting collar. Before insertion, the packings should be soaked in oil, mineral, hydraulic buffer. Tallow should **not** be used.

**74. Leakage.**—The object of all packings is to prevent leakage. If excessive leakage is observed, an examination of packings should be carried out, and the packings either replaced or the glands tightened. Over-tightening of glands should be avoided. Glands should be tightened if possible whilst the equipment is warm from firing.

75.

## TASK TABLES

Task No.	Items.	Task.	Reference Paragraphs.
<b>Daily</b> 1	Barrel and recuperator spring	Clean and lubricate, using injector and sponge cleaning rod, No. 5 sponge brush, No. 7 wool cleaner, Oil C 70, Grase G.S. or No. 0, rags and waste. Tools required :—Barrel bearer and barrel wrench	63, 77, 89
2	Breech block and firing mechanism	Clean and lubricate, using oil, C 70 and white lubricant (special). Tools required :—Operating cover key, extractor spindle and safety plunger key, hand cartridge extractor, No. 25 striker protrusion gauge, and closing spring setting tool, key firing hole bush	62, 77, 83, 96
3	Auto loader and inside gun casing. Test tension of feed spring	Clean and lubricate, using oil, C 70 and white lubricant (special), rags and waste. Tools required :—Operating cover key, firing hole bush key, two adjustable spanners, small screwdriver, feed rod spring clamp, loader lifting tool and medium screwdriver and spring balance 30-lb. Use oil 10 H.D. for the four lubricators or breech casing	77
4	Wheels . . . . .	Clean, inspect, and if necessary tighten wheel nuts. Inflate to correct pressure. Remove stones, etc., from tyres. Tools required :—Pressure gauge ; wheel nut wrench	25-28, 77, 132
5	Brakes . . . . .	Clean and inspect. Report any leakage of fluid. Test for efficient braking action	97

75.

Task No.

6

P

7

E

8

S

9

Every  
other day  
10

11

Twice  
weekly  
12Weekly  
or after  
firing  
13Weekly if  
gun does  
not fire)  
14

75.

**TASK TABLES**—*continued*

Task No.	Items.	Task.	Reference Paragraphs.
6	Platform and Mounting ..	Inspect and lubricate generally. Tighten loose bolts and studs. Use oil C 600, C 70 and grease G.S.	77, 90
7	Buffer .. ..	Check for correct quantity of oil, top up if necessary. Tools required :—No. 14 cylinder filling funnel, wrenches Nos. 340 and 341. Use correct liquid as laid down in para. 70	70-74, 75
8	Sights.. ..	Test and adjust. Oil lightly. Tools required :—Small screwdriver and small adjustable spanner pliers	98-99
9	Ammunition .. ..	Clean and check, using lead free mineral jelly, rags and waste	124-131
<b>Every other day</b> 10	Elevating gear, cradle balancing springs	Test, clean and lubricate, using injector and tool artillery No. 180 and spanner No. 351. Oil C 600, oil 10 H.D. in Mark 3 mountings, and grease GS, or No. 0	92-94
11	Traversing gear, loading platform	Clean and lubricate, using injector, oil C 600, oil 10 H.D. in Mark 3 mountings, oil C 70 and grease G.S. or No. 0. Rags and waste. Spring balance	93, 95
<b>Twice weekly</b> 12	Gun stay .. ..	Clean and lubricate, using oil C 600, rags and waste	21
<b>Weekly or after firing</b> 13	Breech ring .. ..	Remove, clean and lubricate using operating cover key, two adjustable spanners, hand cartridge extractors, firing hole bush key, safety plunger seat key, extractor spindle and safety plunger key, barrel wrench, wrench No. 341, barrel bearer, medium screwdriver, grease graphited G.S., rags and waste	77, 80 (ii)
<b>Weekly if gun does not fire)</b> 14	Barrel, auto-loader and breech casing	Remove barrel and auto-loader and operate breech ring in recoil and run-out using operating cover key, two adjustable spanners, * small screwdriver, tools lifting auto-loader, bearer barrel and barrel wrench, oil 10 HD, grease graphited, G.S. oil C 70	79, 82

75.

**TASK TABLES**—continued

Task No.	Items	Task	Reference: Paragraphs
<b>Monthly</b> 15	Oil units .. ..	Top up using light torpoyl and O.S. 6252 oil gun NOTE.—In no circumstances may the oil filters be removed from the oil unit. The torpoyl must be clean, and container resealed immediately after use to prevent ingress of dust or moisture Use oil 10 H.D. for lubricators of oil units	93
16	Electric circuit .. ..	Test insulation using resistance tester (Megger or anometer)	96
17	Oil unit .. ..	Check oiling of re-setter worm using light torpoyl and $\frac{1}{4}$ -in. spanner. Drain, clean out and refill with fresh oil using oil unit ball tongs, oil unit pilot valve tool, wheel pulling tool, filter bobbin removing tool light torpoyl, 7 in. oil gun, spanners and screwdrivers	93

**SECTION 4**

76.

**LUBRICATION****LIST OF LUBRICATORS AND LUBRICATION CHARTS**

## Mounting—

Mark 1 ... .. Fig. 33  
 Mark 3 (Typical for Mark 4) ... .. Fig. 34

## Platform—

Mark 1 ... .. Fig. 35  
 Mark 2 ... .. Fig. 36

Correctional Sight, Mark 5/1 ... .. Fig. 37



# LIST OF LUBRICATORS

NUMBER ON CHART	POSITION	CODE LETTER
1.	Control bar securing bolt	B
2.	Supporting frame spacer	B
3.	A.A. Deflection operating lever adapter	B
4 & 5	Connecting shaft bearing	B

## CODE LETTER KEY

Oil C. 600.....B

## NOTE

These lubricants are for use under normal conditions. Alternatives for abnormal conditions are given in paragraph 77

## MARK 5/1 CORRECTIONAL SIGHT

### LUBRICATION CHART

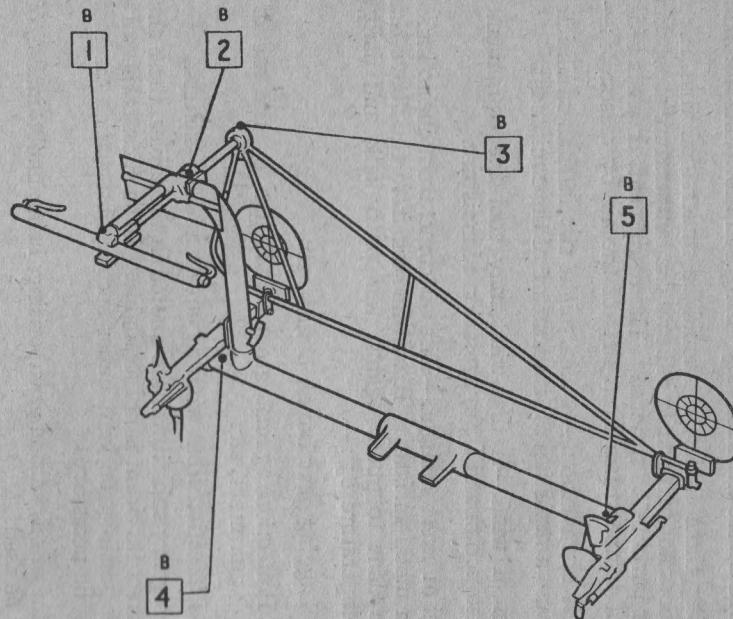


FIG. 37.

The following table indicates the lubricants which are suitable for use in the 40-mm. A.A. equipments.

An overlap of 5 degrees F. between the temperature ranges shown should not be exceeded before the necessary changes in lubricants are made.

When using these tables, it should be understood that the surrounding temperature does not necessarily indicate the temperature as working condition of the gear or parts to be serviced. The equipment, or parts of it, may be at quite different temperatures from that of the air by reason of :—

- (a) **Effects of radiation.**—A clear night sky induces radiation which may cause a rapid fall of temperature of the equipment.
- (b) **Effect of wind.**—A dry wind may cool the equipment rapidly by conduction and by evaporation of moisture.
- (c) **Effect of direct sunlight.**—Rise of temperature due to incident sunlight on metal surfaces. It will be seen from the above that much can be done to guard against temporary falls and daily changes of temperature by :—
  - (i) Lagging gear boxes, buffers, etc.
  - (ii) Protection against ground radiation by the use of tarpaulins, gun nests, etc.
  - (iii) Protection from wind by covers and by shelters.

Where emergency substitutes are quoted in the tables, these should only be used if the correct lubricant is not available. In such cases the parts concerned should, where possible, be kept under special observation, as more frequent servicing may be necessary.

In the event of oil, kerosene, vaporising, being unobtainable, oil, kerosene, burning, may be used.

Mixtures should be prepared in the proportions as shown in the table by volume.

NOTES.—(1) Where practicable, all old lubricants should be removed before application of fresh.

(2) Lubricating holes must be kept clean. Wherever possible, a ring of the appropriate colour should be painted around each lubricating point.

(3) All lubricants must be kept free from dirt in stoppered bottles or tins with tight covers, all of which should be clearly marked in accordance with the colour code.

(4) Care must be taken to keep oil and grease off tyres, electrical leads, all rubber parts, brake drums and friction linings.

## LUBRICANTS

77. The following table gives the colour code and lubricants for the 40-mm. equipment at various conditions of temperature :—

Lubricants to be used for Temperatures.

The following table indicates the lubricants which are suitable for use in the 40-mm. A.A. equipments.

An overlap of 5 degrees F. between the temperature ranges shown should not be exceeded before the necessary changes in lubricants are made.

When using these tables, it should be understood that the surrounding temperature does not necessarily indicate the temperature as working condition of the gear or parts to be serviced. The equipment, or parts of it, may be at quite different temperatures from that of the air by reason of :—

- (a) **Effects of radiation.**—A clear night sky induces radiation which may cause a rapid fall of temperature of the equipment.
- (b) **Effect of wind.**—A dry wind may cool the equipment rapidly by conduction and by evaporation of moisture.
- (c) **Effect of direct sunlight.**—Rise of temperature due to incident sunlight on metal surfaces. It will be seen from the above that much can be done to guard against temporary falls and daily changes of temperature by :—
  - (i) Lagging gear boxes, buffers, etc.
  - (ii) Protection against ground radiation by the use of tarpaulins, gun nests, etc.
  - (iii) Protection from wind by covers and by shelters.

Where emergency substitutes are quoted in the tables, these should only be used if the correct lubricant is not available. In such cases the parts concerned should, where possible, be kept under special observation, as more frequent servicing may be necessary.

In the event of oil, kerosene, vaporising, being unobtainable, oil, kerosene, burning, may be used.

Mixtures should be prepared in the proportions as shown in the table by volume.

NOTES.—(1) Where practicable, all old lubricants should be removed before application of fresh.

(2) Lubricating holes must be kept clean. Wherever possible, a ring of the appropriate colour should be painted around each lubricating point.

(3) All lubricants must be kept free from dirt in stoppered bottles or tins with tight covers, all of which should be clearly marked in accordance with the colour code.

(4) Care must be taken to keep oil and grease off tyres, electrical leads, all rubber parts, brake drums and friction linings.

LUBRICANTS  
The following table gives the colour code and lubricants for the 40-mm. equipment at various conditions of temperature :—  
Lubricants to be used for Temperatures.



## LUBRICANTS

77. The following table gives the colour code and lubricants for the 40-mm. equipment at various conditions of temperature :—

Lubricants to be used for Temperatures.				
Colour Code.	Use.	150 to 40 degrees F.	40 to 0 degrees F.	0 to — 50 degrees F.
Red	For forced feed lubrication. To be used in all lubricators except the four on the breech casing and lubricators of oil units. Also for wheel hubs with plain bearings.	Oil C 600.	Mixture of :— 3 parts—Oil C 600. 1 part—Oil, kerosene, vaporizing	<b>0 to — 30 degrees F.</b> Oil min. hyd. buffer (CS 1117B). <b>Below — 30 degrees F.</b> Mixture of :— 4 parts oil min. hyd. buffer (CS 1117B). 1 part oil, kerosene, vaporizing.
Yellow	Cleaning bright parts of guns and mountings, preventing rust and for general purposes of lubrication :—Striker, striker spring, cocking levers, extractors, extractor spindles, crankshaft (less rollers), inner cranks (less lugs), safety plunger, breech ring (less interrupted threads, bearing strips and guideways for breech block). Top cover plate, bottom cover plate, lever foot pedal held, trip switch gear mechanism, firing plunger loading tray (less roller paths), feed and stop pawls, feed cylinders, feed cylinder catches, torsional springs, feed control mechanism, bore and chamber (after drying), clinometer plane.	Oil C 70.	Oil, low cold test, No. 2.	<b>0 to — 40 degrees F.</b> Oil, low cold test No. 2. <b>Below — 40 degrees F.</b> Mixture of :— 5 parts—Oil, low cold test, No. 2. 1 part—Oil, kerosene, vaporizing.
		Oil M 80 (black in colour code).	Mixture of— 4 parts—Oil C 70 or oil M 80. 1 part—Oil, kerosene, vaporizing	Mixture of :— 5 parts—Oil C 70 or oil M 80. 2 parts—Oil, kerosene, vaporizing.

### Emergency substitute.

Colour Code.	Use.	Lubricants to be used for Temperatures		
		150 to 40 degrees F.	* 40 to 0 degrees F.	0 to — 50 degrees
T <b>White</b>	Enclosed gears where pressure lubrication is not used nor any other lubricant used :— Breech closing spring, firing mechanism inside gun casing, rammer spring, rammer lever and spring, loading trays, pawls and plungers, journals, journal springs and plungers, all levers and plungers in base of auto-loader, recuperator spring, elevating arc.	Grease G.S.	Grease No. 0.	Grease No. 0.
		<b>Emergency substitute.</b>		
		Mixture of :— 2 parts—Mineral jelly. 1 part—Oil C 70.	Mixture of :— 2 parts—Mineral jelly. 1 part—2 to 1 mixture of oil C 70 and oil, kerosene, vaporizing.	Mixture of :— 1 part—Mineral jelly. 1 part—2 to 1 mixture of oil C 70 and oil, kerosene, vaporizing.
<b>Half-white Red</b>	For external screw threads and interrupted threads of barrel and breech ring.	Grease G.S., graphited.	Mixture of :— 5 parts—Grease G.S., graphited. 1 part—Oil kerosene, vaporizing.	Mixture of :— 5 parts—Grease, G.S., graphited. 2 parts—Oil, kerosene, vaporizing.
<b>White</b>	To reduce wear on towing eyes and hooks and in wheel hubs with ball and roller bearings.	Grease G.S.	Grease No. 0.	Grease No. 0.
		<b>Emergency substitute.</b>		
			Mixture of :— 5 parts—Grease G.S. 1 part—Oil, kerosene, vaporizing.	Mixture of :— 5 parts—Grease G.S. 2 parts—Oil, kerosene, vaporizing.
<b>Half-white Black</b>	For elevating gear worm and bevel cass, and traversing gear large bevel gear case on mountings 40-mm. A.A. Marks 3 to 5.	Oil, 10 H.D.	Mixture of :— 4 parts—Oil, 10 H.D. 1 part—Oil, kerosene, vaporizing.	Mixture of :— 5 parts—Oil, 10 H.D. 2 parts—Oil, kerosene, vaporizing.

Colour Code.	Use.	Lubricants to be used for Temperatures		
		150 to 40 degrees F.	40 to 0 degrees F.	0 to — 50 degrees F.

1 part—Oil, kerosene, vaporizing.

5 parts—Oil, 10 H.D.  
2 parts—Oil, kerosene, vaporizing.

Colour Code.	Use.	Lubricants to be used for Temperatures		
		150 to 40 degrees F.	40 to 0 degrees F.	0 to — 50 degrees F.
<b>Blue</b>	Slides, guideways and bearing strips of gun and breech casing and the four lubricators on the breech casing.	Mixture of :— 10 parts—Oil C 600. 1 part—Oil graphited, concentrate.	Mixture of :— 2 parts—10 to 1 mixture of oil C. 600 and oil graphited, concentrate. 1 part—Oil, kerosene, vaporizing.	<b>0 to — 30 degrees F.</b> Mixture of :— 10 parts—Oil, min. hyd. buffer (CS 1117B). 1 part—Oil graphited, concentrate. <b>Below — 30 degrees F.</b> 4 parts—Above mixture. 1 part—Oil, kerosene, vaporizing.
<b>No colour</b>	As a general preservative, including gun bores, for long storage in all climates, including humid tropical climates.	Mineral jelly mixture (C.S. 2296).	Mineral jelly mixture (C.S. 2296).	Mineral jelly mixture (C.S. 2296).
<b>White</b>	Auto-loader and breech mechanism :—Sides of breech block, roller paths of loading tray, rollers of feed rods, rollers of crankshafts, lug of inner cranks, cam surface of side operating door.	Grease G.S., No. 2.	Mixture of :— 5 parts—Special white lubricant. 1 part—Oil, kerosene, vaporizing.	Mixture of :— 5 parts—Special white lubricant. 2 parts—Oil, kerosene, vaporizing.
<b>White</b>	As a general preservative for short periods under normal conditions.	<b>Emergency substitute.</b>		
		Grease G.S.	Grease No. 0.	Grease No. 0.
		Grease G.S.	Grease No. 0.	Grease No. 0.
		<b>Emergency substitute.</b>		
		Mineral jelly.	Mixture of :— 5 parts—Grease G.S. 1 part—Oil, kerosene, vaporizing.	Mixture of :— 5 parts—Grease G.S. 2 parts—Oil, kerosene, vaporizing.





## SECTION 5

## STRIPPING AND ASSEMBLING

**78. General remarks.**—Stripping and assembling are to be done with care and without violence. No unnecessary force is to be employed, and every precaution is to be taken to avoid damage. Only those spanners and other implements that are provided with the equipment are to be used, and only for the purpose for which they are designed. When it is necessary to use a hammer, a piece of wood or soft metal should be interposed to transmit the blow.

The order of stripping is as described on each illustration.

It will be necessary to elevate the gun for the operations shown in Fig. 38.

It is essential that the gun be laid horizontal for the following operations :—

Fig. 39	...	...	...	...	...	All.
Fig. 40	...	...	...	...	...	No. 1.
Fig. 45	...	...	...	...	...	Nos. 1 and 2.
Fig. 46	...	...	...	...	...	All.
Fig. 47	...	...	...	...	...	All.

The hand operating lever must be raised when dismantling—Figs. 38 (1), (3) and (5), and 40 (1).

Where automatic loaders are not fitted with guard plates, great care must be taken when placing the automatic loader on a flat surface, after its removal from the breech casing, to avoid damage to the cylinder catch release spindle. The slightest tilting movement at the moment of contact may result in the bending of the spindle.

When a barrel has been removed the breech casing has a barrel preponderance; therefore, during the operation of removing and replacing the barrel, the breech casing should be secured :—

- (a) To the gun stay if possible.
- (b) By lashing.
- (c) By the elevating handle being firmly held.

**79. To dismantle****(i) The buffer.**

- (a) Remove the locking pin and securing pin from the rear end of the piston rod.
- (b) Remove filling and emptying plugs and allow liquid to run into a clean container.
- (c) Remove packing, etc., from the front end of the control rod and unscrew the run-out adjusting valve.
- (d) Unscrew the cylinder gland bush. Remove piston rod rear gland ring, etc.
- (e) Remove the securing screw and unscrew the control rod from the buffer cylinder, and withdraw the control and piston rods together.
- (f) Slacken the grub screw and unscrew the throttling bush from front end of piston rod. Withdraw the control rod from the piston rod.
- (g) Dismantle the non-return valve.
- (h) Remove taper pin and unscrew the valve seat from the rear end of the control rod.
- (i) Slide the throttling bush from the control rod.

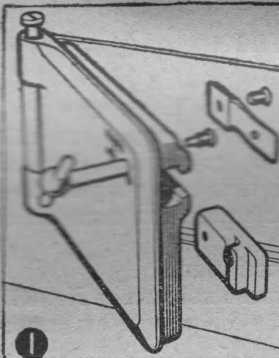
**(ii) Breech mechanism.** (See Fig. 38.)**(iii) Breech casing rear cover.** (See Fig. 39.)**(iv) Automatic loader "A."**

Rammer and loading tray. (See Fig. 40.)

Side fittings. (See Figs. 41 and 42.)

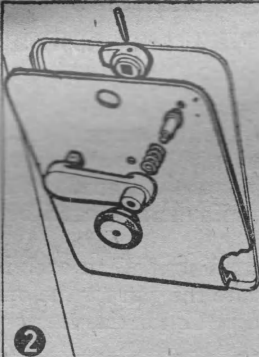
Base fittings. (See Figs. 43 and 44.)

# TO DISMANTLE BREECH MECHANISM



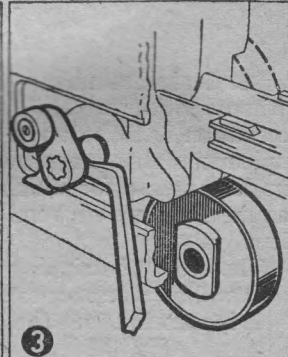
1

With KEY provided, open the OPERATING COVER & dismantle the SPRING and CATCH, remove the HINGE BOLT and COVER.



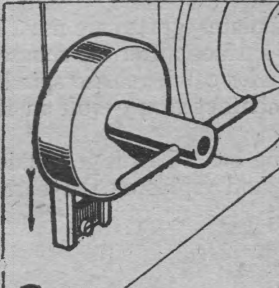
2

Release BOTTOM COVER CLOSING CATCH, remove the BOTTOM COVER.



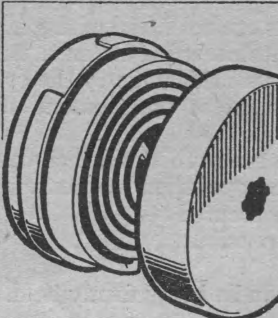
3

Using HAND CARTRIDGE EXTRACTOR, prise OUTER CRANK and CRANK-SHAFT to the left until clear of CLOSING SPRING CASE. Remove CASE.



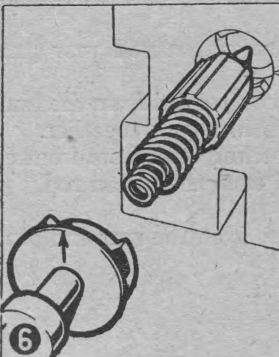
4

Place CLOSING SPRING CASE on its BRACKET on BREECH CASING with feather downwards. Insert CLOSING SPRING SETTING TOOL so that splines engage. Force CLOSING SPRING COVER toward BREECH CASING. Permit it to rotate anti-clockwise. Do not allow tension to come off spring violently. Remove TOOL, COVER, SPRING & CASE from bracket



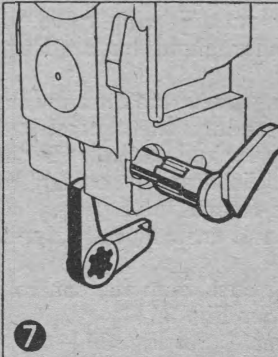
5

Support BREECH BLOCK, & INNER CRANKS. Withdraw OUTER CRANK & CRANK-SHAFT. Remove BREECH BLOCK & INNER CRANKS. Remove the TAPER PIN and separate the OUTER CRANK from CRANK-SHAFT.



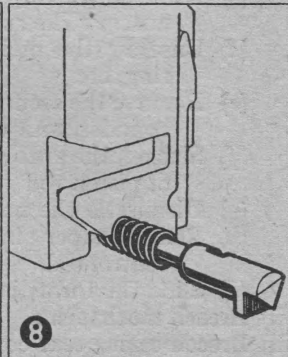
6

With the FIRING HOLE BUSH KEY remove the STRIKER SPRING COVER. Withdraw the STRIKER SPRINGS & STRIKER from BREECH BLOCK.



7

Withdraw OUTER COCKING LEVER & remove the INNER COCKING LEVER from the BREECH BLOCK.



8

Dismantle CHECK PLUNGER and SPRING from the BREECH BLOCK.

FIG. 38.



# TO DISMANTLE BREECH CASING REAR COVER

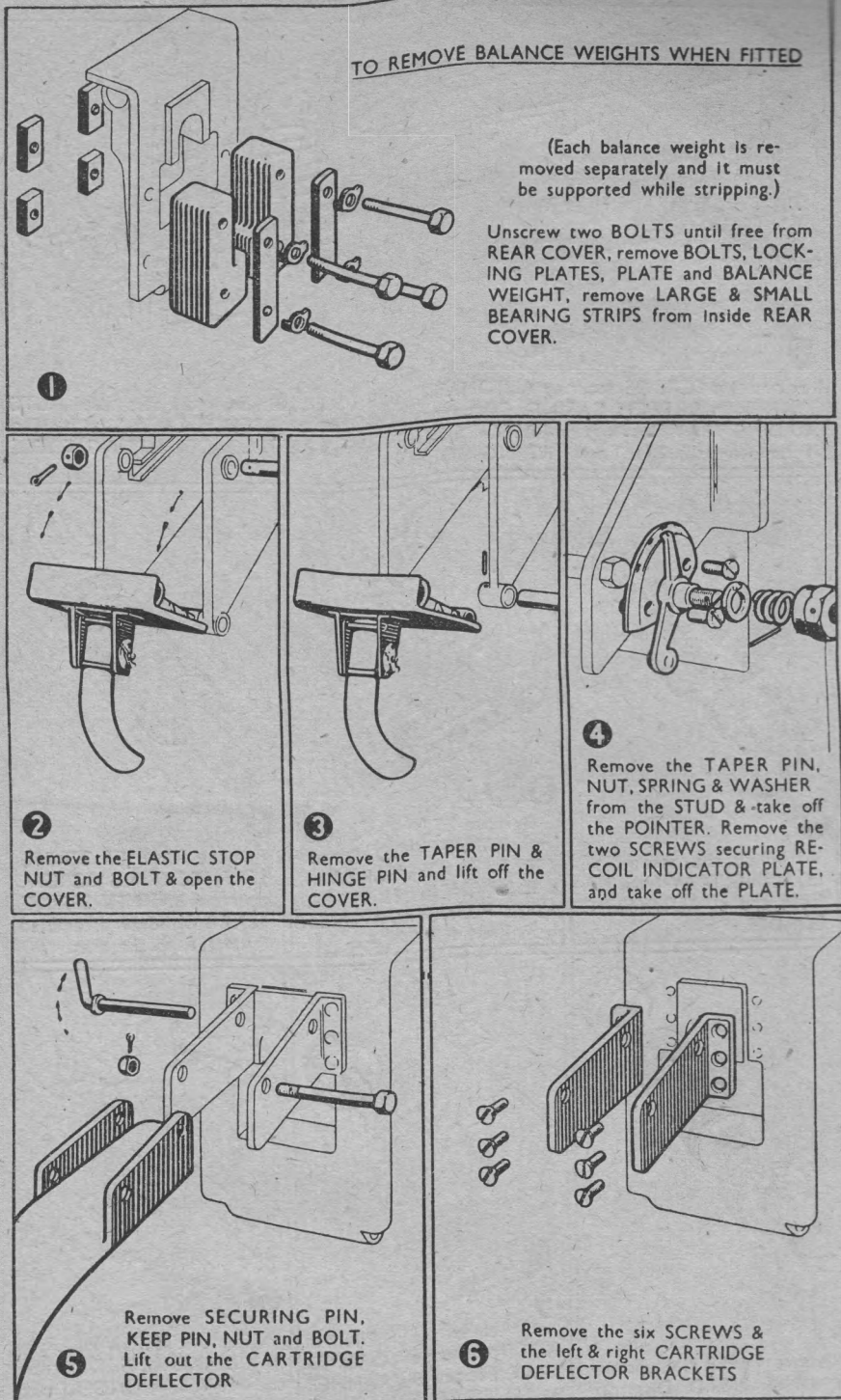
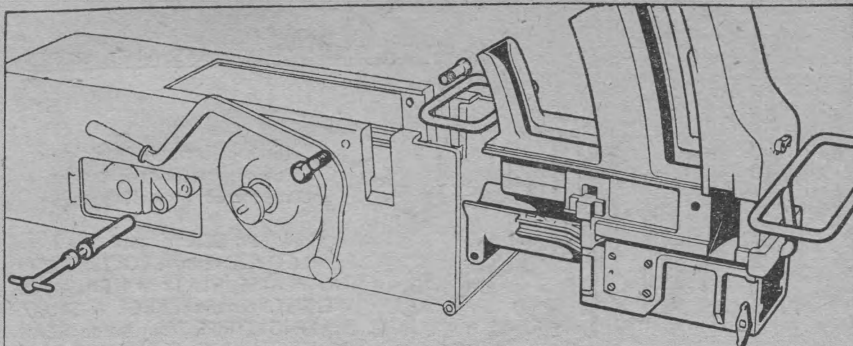


FIG. 39.

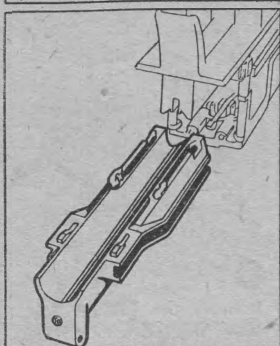
# TO DISMANTLE AUTOMATIC LOADER RAMMER AND LOADING TRAY.



①

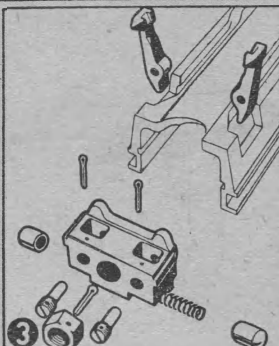
Remove two SCREWS securing AUTOMATIC LOADER in BREECH CASING. Disconnect LOADING TRAY from lugs on BREECH RING by removing the BOLT with FIRING HOLE

BUSH KEY. Withdraw the assembled AUTO LOADER from BREECH CASING with aid of FRONT & REAR LOADER LIFTING TOOLS.

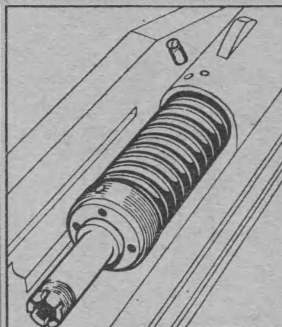


②

Withdraw the assembled LOADING TRAY from the front end of AUTOMATIC LOADER.

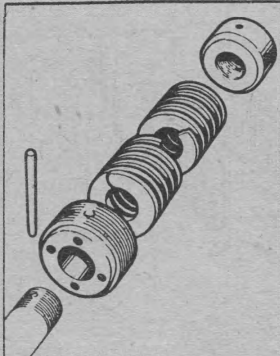


Remove KEEP PIN & NUT from RAMMER ROD. Remove KEEP PINS, AXIS SCREWS, L. & R. RAMMER LEVERS. Dismantle PLUNGERS & SPRING from RAMMER SHOE.



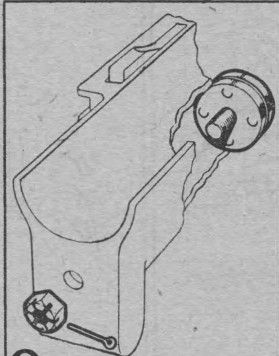
④

Remove RAMMER SPRING SEAT SECURING SCREW, unscrew RAMMER SPRING SEAT & withdraw assembled RAMMER to the rear.



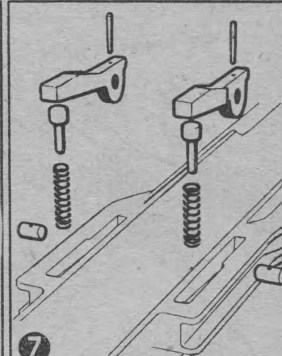
⑤

Remove TAPER PIN, unscrew RAMMER HEAD. Dismantle RAMMER SPRING and SEAT.



⑥

Remove KEEP PIN and NUT from front of LOADING TRAY. Extract the RAMMER BUFFER PAD from rear of LOADING TRAY.



⑦

Remove TAPER PINS and PAWL AXIS PINS. Dismantle the PAWLS, PLUNGERS and SPRINGS from LOADING TRAY.

FIG. 40.

## TO DISMANTLE AUTOMATIC LOADER SIDE FITTINGS.

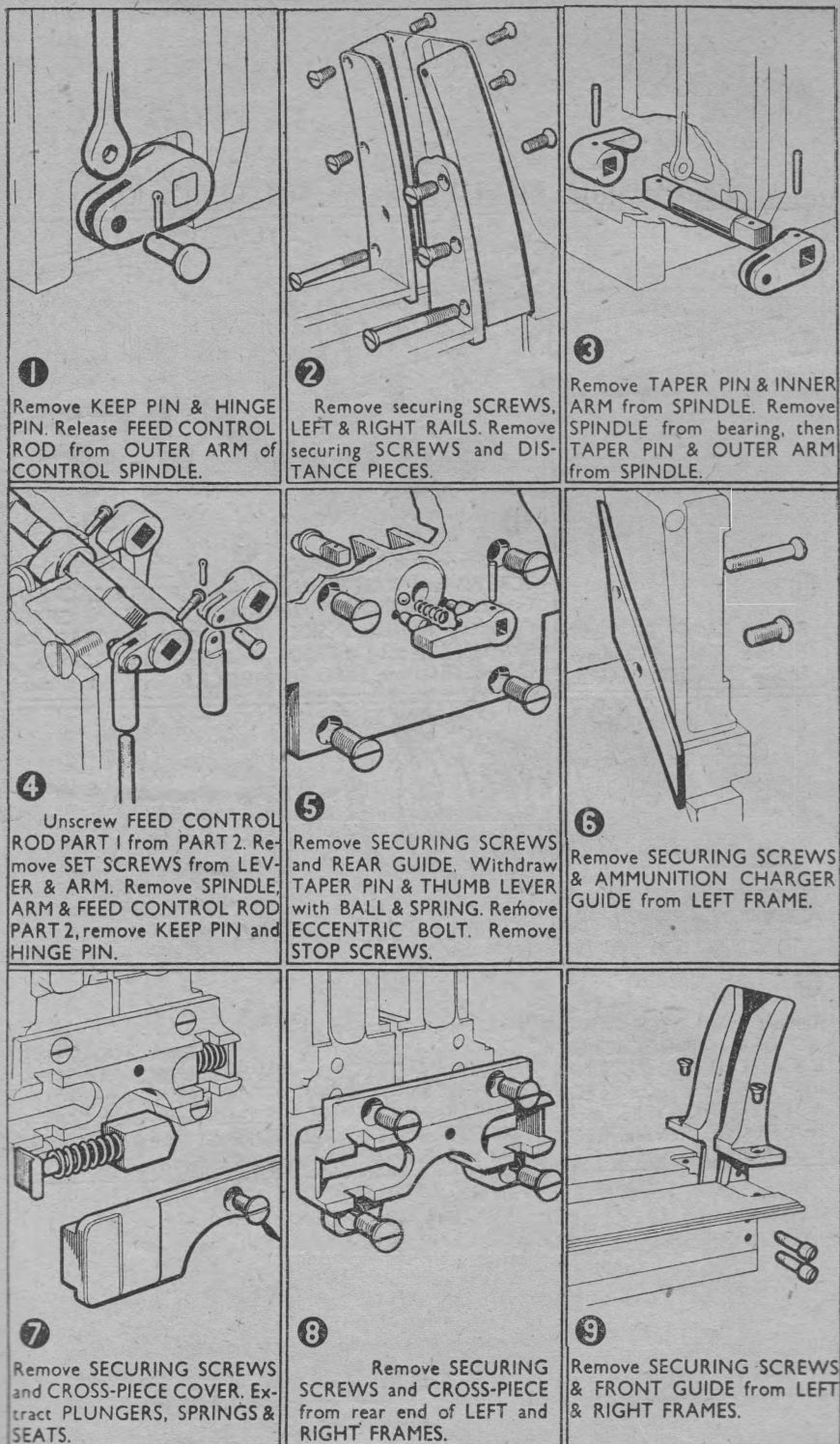


FIG. 41.



# TO DISMANTLE AUTOMATIC LOADER SIDE FITTINGS (CONT.)

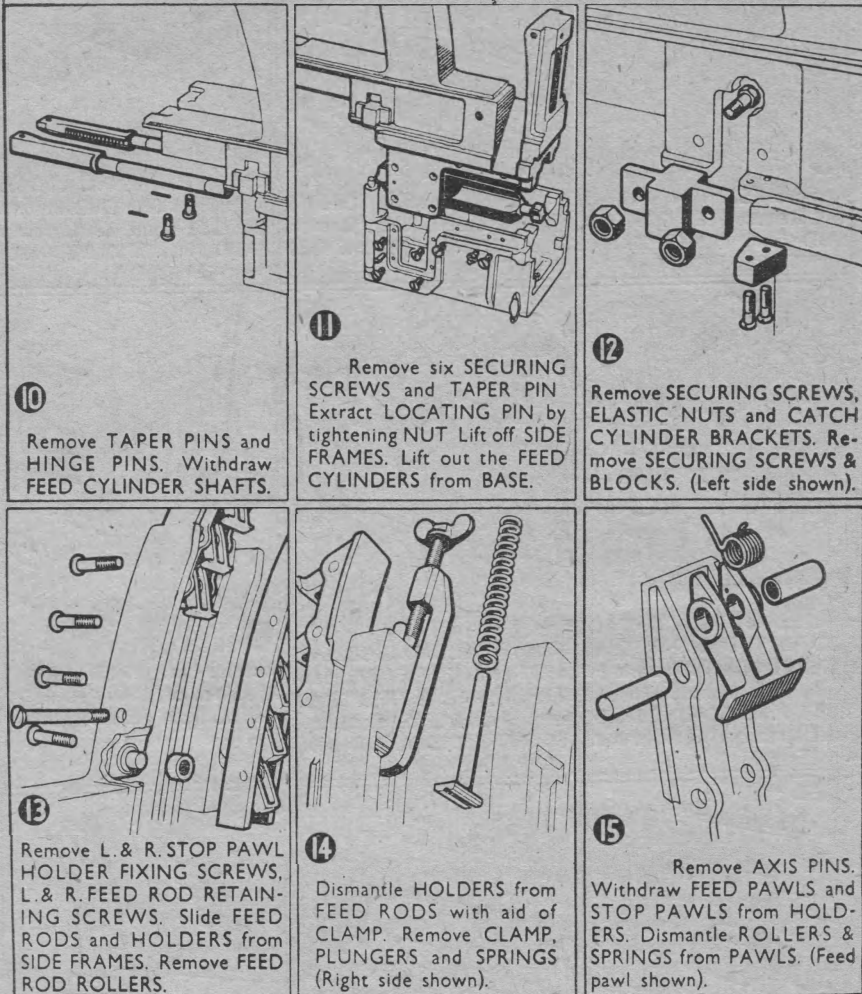


FIG. 42.

## TO DISMANTLE AUTOMATIC LOADER BASE FITTINGS

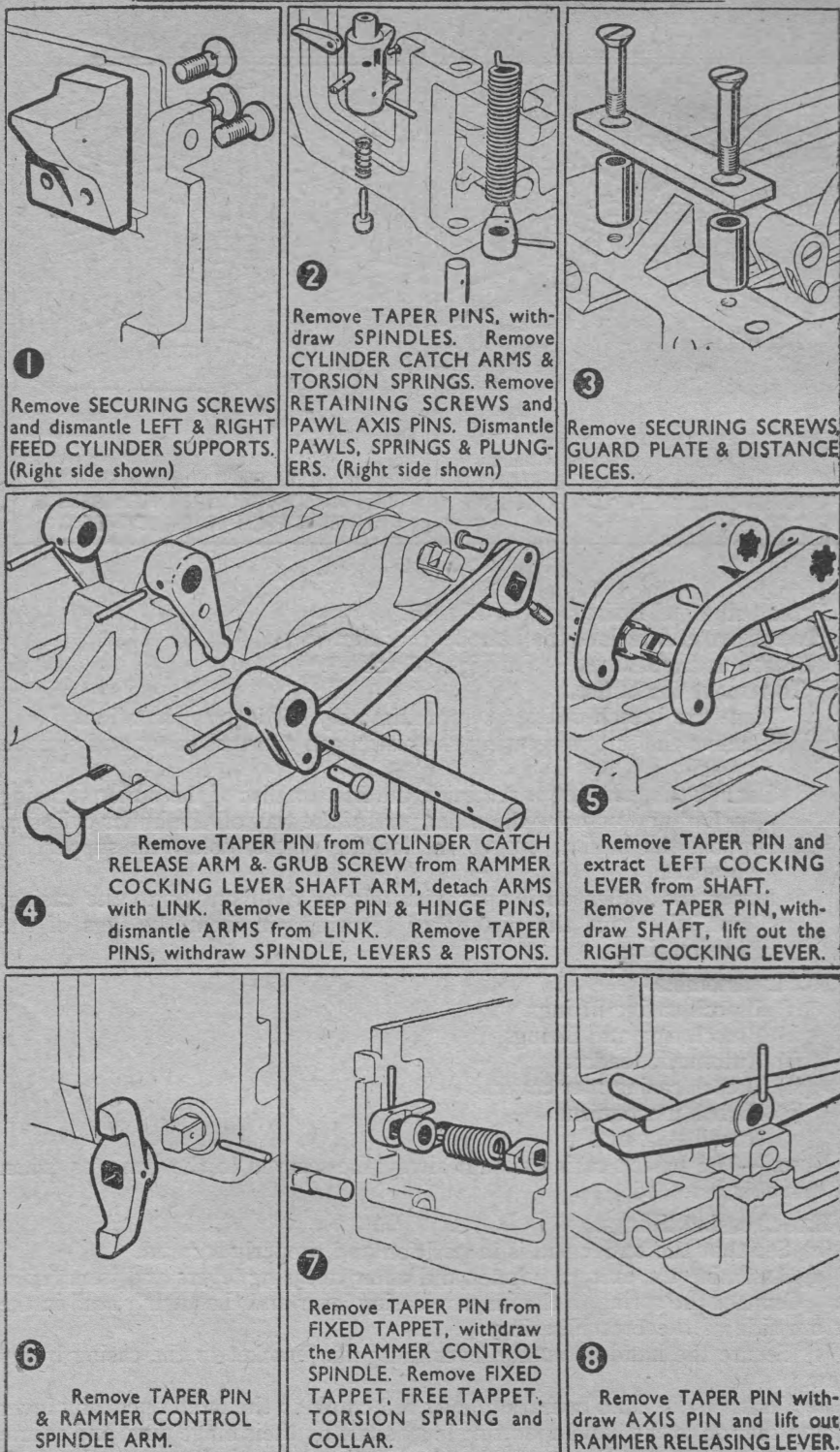


FIG. 43.

## TO DISMANTLE, AUTOMATIC LOADER BASE FITTINGS (CONT.)

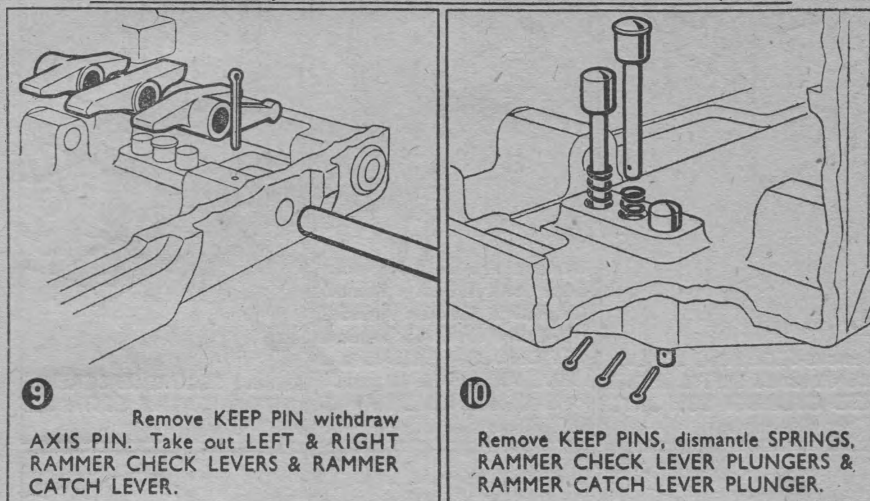


FIG. 44.

(v) **Breech ring and fittings.** (See Fig. 45.)

(vi) **To remove and replace the barrel.** (See Fig. 45.)

(vii) **Breech casing fittings.** (See Figs. 46 and 47.)

(viii) **To remove the buffer.**

- (a) Place the breech casing at approximately 45 degrees elevation.
- (b) Remove the screws securing the piston rod aperture cover and remove cover.
- (c) Slacken the grub screw retaining the friction disc of the buffer securing collar, and unscrew the collar part of the way off the buffer cylinder.
- (d) Support the buffer, remove the locking plates, bolts and supporting bracket.
- (e) Lower the buffer until approximately at right angles to the casing, and disengage the piston rod securing pin from the lugs of the breech ring.

### 80. To assemble.

- (i) Breech casing fittings.
- (ii) Breech ring and fittings.
- (iii) Automatic loader.
- (iv) Breech casing rear cover.
- (v) Breech mechanism.
- (vi) Recoil system.

NOTE.—The breech casing should always be secured to the gun stay when the barrel is removed.

(i) **Breech casing fittings.**

- (a) See that the buffer pad is in position and properly secured.
- (b) Assemble the extractor inner and outer releasing levers and insert split pin. Connect the spring to the inner releasing lever and the anchor stud in the bottom side of the breech casing.
- (c) Secure the hand operating lever rod guide bracket to the casing by its screw.

(d) Connect the hand operating lever rod crank to the hand operating lever rod and the rod to the hand operating lever shaft by their hinge pins, and secure them with split pins. Secure the hand operating lever shaft arm to the shaft



## TO DISMANTLE BREECH RING AND FITTINGS

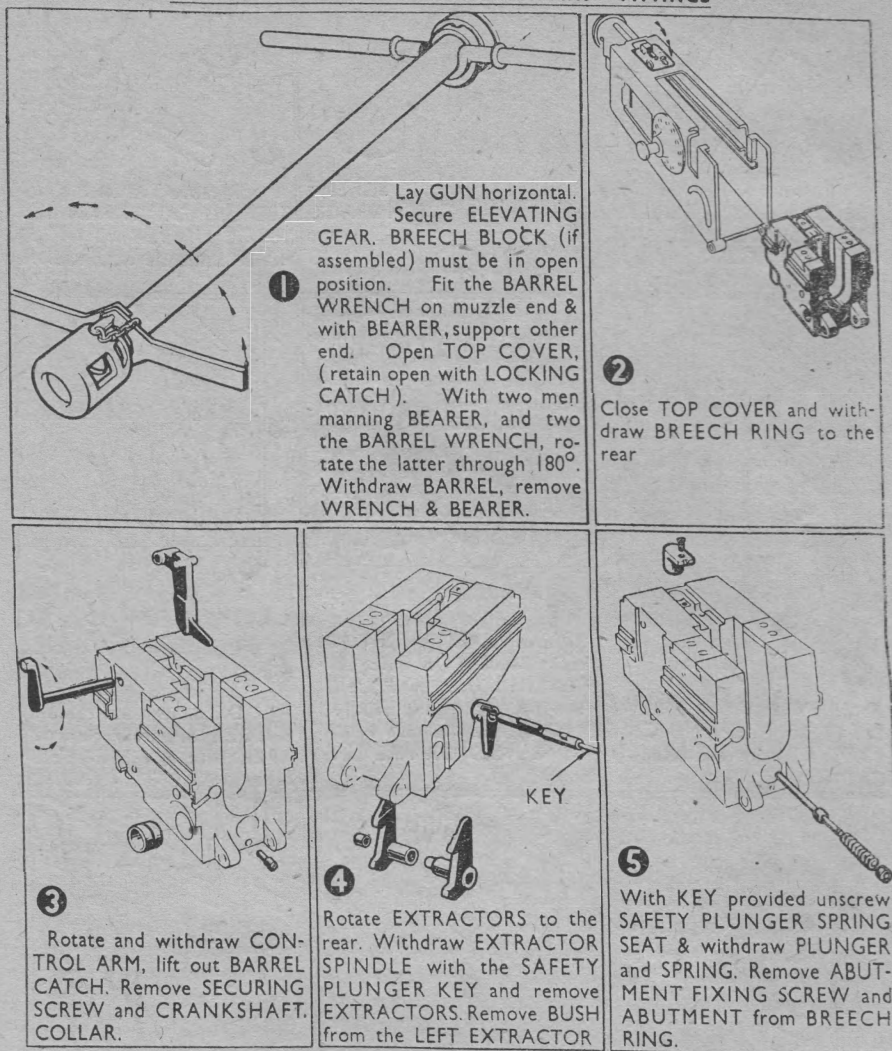


FIG. 45.

## TO DISMANTLE BREECH CASING FITTINGS

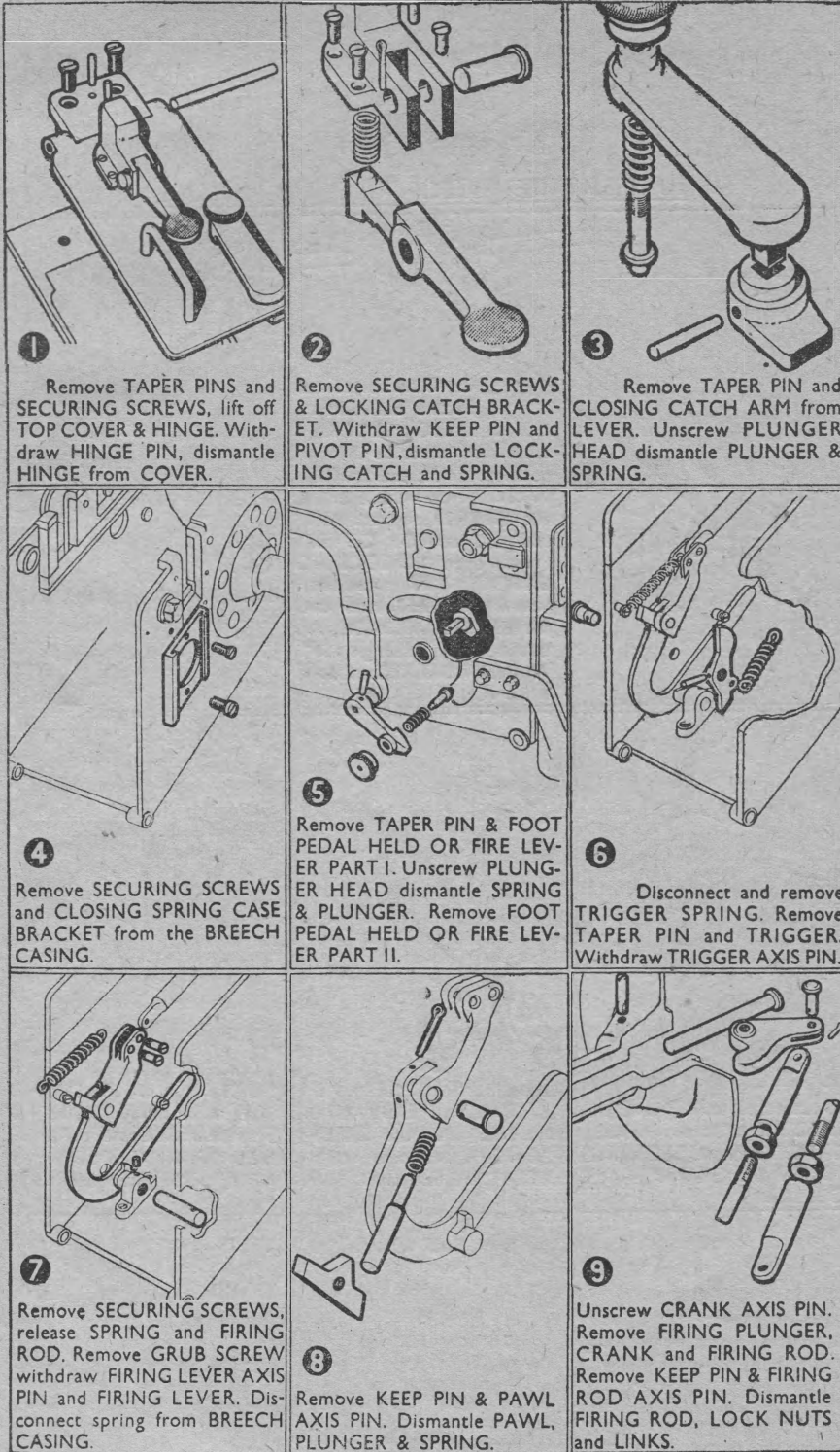
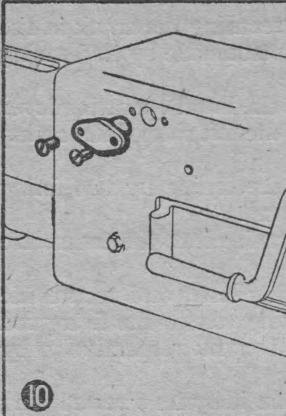
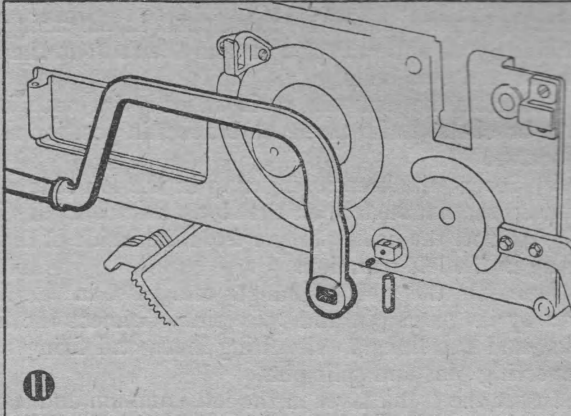


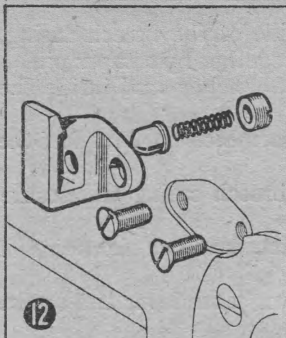
FIG. 46.

**TO DISMANTLE BREECH CASING FITTINGS (CONT.)**

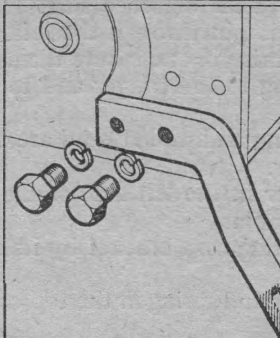
**10**  
Remove two **FIXING SCREWS** & **BREECH RING STOP** from left side of **BREECH CASING**.



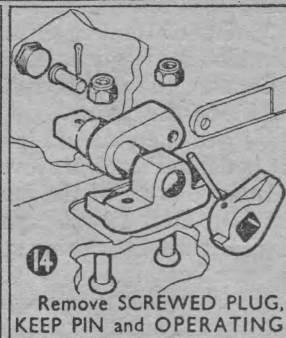
**11**  
Remove **GRUB SCREW** from end of **HAND OPERATING LEVER SHAFT**. Withdraw **LOCKING PIN** and take off **HAND OPERATING LEVER**.



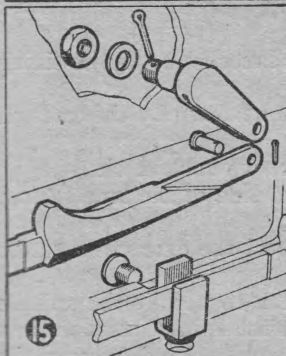
**12**  
Remove **SECURING SCREWS** & **CATCH BRACKETS** from left side of **CASING**. Dismantle **SPRING SEATS**, **SPRINGS** and **PLUNGER**. (Front bracket shewn)



**13**  
Remove two **SECURING BOLTS** and **HAND OPERATING LEVER STOP BRACKET**.



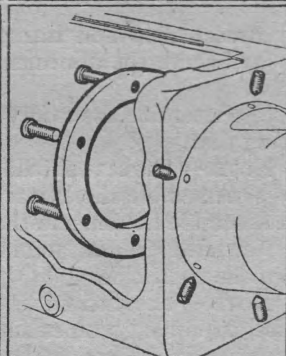
**14**  
Remove **SCREWED PLUG**, **KEEP PIN** and **OPERATING ROD HINGE PIN**. Remove **TAPER PIN** & **SHAFT ARM**.  
Remove **ELASTIC STOP NUTS**, **BOLTS**, & **BEARING BRACKET** with **SHAFT**. Withdraw **SHAFT** from **BEARING BRACKET**.



**15**  
Remove **KEEP PIN**, **HINGE PIN** & **HAND OPERATING ROD**. Remove **KEEP PIN**, **LOCK NUT**, **WASHER** and **CRANK**. Remove **SECURING SCREW** & **GUIDE BRACKET**.



**16**  
Dismantle the **SPRING**. Remove **KEEP PIN** & dismantle the **INNER** and the **OUTER EXTRACTOR RELEASING LEVERS**.



**17**  
Remove six **GRUB SCREWS** and six **SECURING SCREWS**. Take out the **BREECH RING BUFFER PAD**.

FIG. 47.



by its taper pin. Assemble these parts in the casing, securing the crank in the left side by its nut and split pin and the shaft to the bottom side by its bearing bracket and two bolts.

Assemble the plungers, springs and spring seats in the hand operating lever catch brackets, and secure each bracket in position on the left side of the casing by screws.

(e) Secure the breech ring stop in the left side of the casing by two fixing screws; the flat surface on the stop must be to the front.

(f) Insert the firing plunger from the inside of the casing into the transverse boring in the left trunnion.

Assemble the spring, plunger and pawl in the firing lever and secure the lever by its pivot pin and split pin. Connect the firing rod to the firing rod links, and the links to the firing lever and firing rod crank respectively, by connecting pins and split pins.

Insert the crank lever in the left trunnion and secure it by its screwed pin; secure the firing lever in position in the bottom of the casing by its axis pin and set screw.

Connect the firing lever spring to the firing lever by its screw and to the anchor stud in the left side of the breech casing.

(g) Insert the trigger axis pin through the left side of the breech casing, assemble the trigger on the axis pin and secure them together by a taper pin.

Connect the trigger spring to the trigger and to its anchor stud inside the left side of the casing.

(h) See the plunger, spring and milled head are assembled on Part I of the foot pedal held and fire lever.

Insert Part I of the lever in the left side of the breech casing and secure Part II to Part I by a taper pin.

(i) Secure the closing spring case bracket by its screws to the right side of the breech casing.

(j) Assemble the plunger and spring in the top cover catch lever and secure them by the knob.

Insert the lever in the cover and secure it by the arm and taper pin.

(k) Assemble the locking catch spring, spring seating and lever in the locking catch bracket and insert the lever pivot pin, securing the pin by a split pin; secure the bracket to the top cover by its screws.

(l) See the top cover hinge is secured to the casing by screws and connect the cover to the hinge by its hinge pin and secure the pin by a taper pin.

## (ii) Breech ring and fittings.

(a) Secure the abutment to the upper side of the breech ring by its fixing screw.

(b) Assemble the safety plunger and spring and secure them by the screwed spring seat.

NOTE.—The seat should be secured in position by four punch marks.

(c) Assemble the extractor spindle arm in the right side of the breech ring. Assemble the bush in the left extractor.

Assemble the extractors in the breech ring and insert the extractor spindle from the right side.

NOTE.—The extractors must be rotated to the rear to permit the spindle to be assembled; on raising the extractors, a key on the spindle engages in a cannellure in the breech ring, thereby retaining the spindle. The tool used for inserting the extractor spindle will not be removed until final assembly of the breech mechanism is completed, so as to ensure that the key on the spindle remains in the cannellure of the breech ring during the operation of replacing the breech block, and thus prevent the possibility of damage or breakage of extractor spindles.

(d) Ins  
securing s

(e) Pla

(f) Cl  
it to the t

NOTE.  
assembled

(iii) Aut

NOTE.  
loaders.  
central pi  
pawls, wi  
controlle

Base

(a) A  
and secu

(b) A  
between  
secure it

(c) I  
lever ax

(d) I  
insert tl

the spin  
end of t

(e) I  
shaft at

insert t  
pins an

Not  
the hin

(f)  
Place t

insert t  
spindle

the cyl  
then as

(g)  
As

heads  
fixing

them  
their

cylind  
spind

house

N  
woun

(h)  
three

S  
(i)

hold  
plan

(d) Insert the crank shaft collar in the breech ring and secure it by its securing screw.

(e) Place the barrel catch in position and insert the control arm.

(f) Close the top cover, insert the breech ring in the breech casing, and secure it to the top cover.

NOTE.—The barrel, with recuperator spring in position, should now be assembled.

### (iii) Automatic loader "A."

NOTE.—Some equipments may be fitted with either B, C, M or M\* auto-loaders. These loaders are of simpler design, and differ chiefly in the upward central projections on the side frames, together with the feed rods, feed and stop pawls, with their respective holders being removed and the fitting of a spring-controlled feed lever in lieu.

#### Base fittings.

(a) Assemble the three springs and plungers of the catch and release device and secure them by split keep pins.

(b) Assemble the rammer right and left check levers with the catch lever between them, insert the catch and check levers axis pin in its bearings and secure it by its taper pin.

(c) Place the rammer releasing lever in position, insert the rammer releasing lever axis pin in its bearings and secure it by its taper pin.

(d) Assemble the collar, torsional spring, free tappet, fixed tappet and insert the rammer control spindle in its bearings and secure the fixed tappet to the spindle by its taper pin. Place the rammer control spindle arm on the left end of the spindle and secure it by its taper pin.

(e) Connect the cylinder catch release link to the rammer cocking lever shaft arm by its hinge pin; place the left and right cocking levers in position; insert the shaft into its bearings and secure the cocking levers by their taper pins and the arm by its grub screw.

NOTE.—The arm is assembled on the right end of the shaft, with the head of the hinge pin to the left, the pin being retained by the right bearing.

(f) Insert the two cylinder catch release pistons in the piston chambers. Place the two cylinder catch release levers in position engaging the pistons, insert the cylinder catch release spindle in its bearing and secure the levers to the spindle by their taper pins. Connect the cylinder catch release spindle arm to the cylinder catch release link by its joint pin and secure the pin by a split pin, then assemble the arm on the right end of the spindle and secure by its taper pin.

(g) Assemble the two feed cylinder catches.

Assemble the catch cylinder pawl plungers and springs in the catch cylinder heads, place the pawls in position, insert the axis pins and secure them by their fixing screws. Place the catch cylinder heads on top of the spindles and secure them by their taper pins. Insert the cylinder catch release spindles through their upper bearings, assemble the torsional springs and, underneath, the cylinder catch arms, and secure them by their taper pins, the lower end of the spindles entering their lower bearings. The ends of the torsional springs are housed in the holes in the base and arm respectively.

NOTE.—The left wound spring is assembled on the right side and the right wound spring on the left side of the base.

(h) Secure each of the left and right feed cylinder supports in position by three screws.

#### Side fittings.

(a) Assemble the feed pawls, pawl springs and pawl rollers in the feed pawl holders, then insert the axis pins. Place the left and right feed rods, feed rod plungers, springs and holders in the frames.

Assemble the stop pawls, pawl spring and pawl holders and place them in the frames in front of the feed pawls. Insert the holder fixing screws.

NOTE.—A feed rod springs clamp is provided for use with the feed rod springs to facilitate assembly and dismantling.

(b) Secure each of the two catch cylinder brackets to the frames by two bolts and split pins and adjacent to each of the two blocks by two screws.

(c) Insert the feed cylinder shafts with their bushes in the front ends of the feed cylinders. Attach the feed cylinder shafts to the underside of the front guide by their hinge screws and secure each screw by its taper pin. Place the feed cylinders and sides in position on the base. Secure the sides to the base by screws.

(d) Secure the front guide to the left and right frames by screws.

(e) Secure the cross-piece to the rear ends of the frames by screws.

(f) Assemble the two feed cylinder plungers, springs and seats, insert them in the cross-piece, and secure the cross-piece cover in position by its screw.

(g) Secure the ammunition charger guide to the left frame and rear guide by screws.

(h) Insert the feed control eccentric bolt in the rear guide from the front, assemble the steel spring and ball in the recess in the thumb lever and place the lever on the rear end of the bolt, securing it by its taper pin. Insert the two thumb lever stop screws.

(i) Place the feed control lever in position in the rear guide, insert the feed control lever spindle in its bearings, assemble the feed control lever on the right end of the spindle and secure them to the spindle by the two set screws.

Connect Part II of the feed control rod to the arm by a hinge pin, securing the pin by a split pin. Connect Part I of the feed control rod to Part II.

Place the inner arm on the left end of the intermediate rammer control spindle, secure it by its taper pin and then insert the spindle, from the left in its bearing in the right side frame. Place the outer arm on the spindle and secure it by its taper pin.

(j) Secure the right rail to the rear guide by screws.

(k) Secure the left upper rail to the rear guide by screws and the left lower rail to the rear guide by screws which pass through the upper rail.

Insert remaining screws.

(l) Connect the feed control rod (Part I) to the outer arm of the intermediate rammer control spindle by a hinge pin, securing the pin by a split pin.

#### **Rammer and loading tray.**

(a) Assemble the pawl springs, plungers and pawls in the upper sides of the loading tray, insert the pawl axis pins and secure them by taper pins.

(b) Secure the rammer buffer pad in the front end of the rammer chamber in the loading tray by its spigot, castellated nut and keep pin.

(c) Place the rammer spring seat over the front end of the rammer rod.

(d) Place the rammer spring on the rod from the front.

(e) Screw the rammer head on to the rammer rod and secure it by its taper pin.

(f) Insert the assembled rammer into the rammer chamber, screw the spring seat home in the chamber and secure it to the tray by its securing screw.

(g) Assemble the rammer lever plunger and spring in the rammer shoe, slide the shoe through its guides in the loading tray, insert the left and right rammer levers through the slots in the loading tray and secure them by their axis screws and split pins. Secure the shoe on the rear end of the rammer rod by its nut and split pin.

(h) Insert the loading tray into the base of the automatic loader from the front, care being taken to see that the loose rollers are assembled on the feed rods.

(i)  
front a  
the bre  
by two

(iv) B

(a)

each s

Pl

the bc

(b)

by tw

As

plate

(c)

pin t

stop

(v) E

(i)

the d

the

(

blo

(

the

the

stri

take

by

by

bre

blo

an

cr

cle

in

is

w

b

fr

c

s

t

s

i

s

1

t



(i) Place the assembled automatic loader in the breech casing, using the front and rear loader lifting tools. Secure the loading tray to the two lugs on the breech ring by its bolt. Secure the automatic loader in the breech casing by two screws. Remove the lifting tools.

(iv) **Breech casing rear cover.**

(a) Secure the left and right cartridge deflector brackets by screws, three on each side, to the rear side of the cover.

Place the cartridge deflector channel between the brackets and secure it by the bolt, nut and split pin at the rear end, the securing pin at the front.

(b) Secure the recoil indicator plate to the right cartridge deflector bracket by two screws.

Assemble the pointer, washer, spring and nut on the stud riveted to the plate and secure the nut by its taper pin. See the pointer is adjusted.

(c) Secure the lower end of the cover to the casing by its hinge pin and the pin by its taper pin. Close the cover, and secure it by its bolt and elastic stop nut.

(v) **Breech mechanism.**

(a) Elevate the breech casing and barrel to approximately 90 degrees.

(b) Insert the firing hole bush locking pin in the breech block, then screw the firing hole bush home in the front face of the block and secure it by forcing the pin across the threads of the bush, or by the retaining screw.

(c) Assemble the check plunger spring and check plunger in the breech block from the right side.

(d) Place the inner cocking lever in position in the breech block and insert the outer cocking lever from the left side.

(e) Assemble the striker and spring in the breech block and secure them by the striker spring cover. The cover is assembled by forcing it in against the striker spring, rotating it through 90 degrees and then releasing it, care being taken to see that the assembly arrows coincide.

(f) Place the outer crank on the left end of the crankshaft and secure it by its taper pin.

(g) Place the right and left inner cranks on their respective sides of the breech block, the cranks to be in the breech closed position. Insert the breech block and cranks through the aperture in the bottom side of the breech casing, and push them into the breech ring to the closed position, and then insert the crankshaft as far as the closing spring case guide; see that the extractors are clear.

NOTE.—Care should be taken to see that the key of the extractor spindle is in its correct relation to the extractor spindle arm whenever the breech block is re-assembled in the gun, *i.e.*, that the key on the extractor spindle is in line with the cannellure in the breech ring, and the extractors can be freely operated by the tool during replacement of the breech block. Do not remove the tool from the extractor spindle until the mechanism is assembled. Assemble the closing spring in its case as follows:—Place the inner cover on the bracket so that the spring retaining stud is to the top. Place the spring in position so that the bent on the outer end of the spring clips over the left of the retaining stud. Place the outer cover in position so that the featherway on the pintle is engaged by the bent on the inner end of the spring. Insert the closing spring setting tool, force in towards the breech casing, and rotate clockwise until the spring forces the outer case away from the breech casing. Remove the tool. Remove the assembled case from the bracket. Insert the assembled closing spring case through the aperture in the bottom plate of the breech casing and slide it into its guide on the right side of the breech ring. Insert the crankshaft and force it home.

(h) Place the bottom cover of the breech casing in position and secure by its closing catch lever.

NOTE.—The closing catch is similar to that of the top cover.

(i) Secure the left side cover in position by its hinge bolt, assemble catch and spring and lock the cover by its catch, using the key provided.

(vi) **Recoil system.**

**To assemble the buffer.**

- (a) Place the throttling bush on the control rod.
- (b) Screw the valve seat in the rear end of the control rod and secure it by its taper pin.
- (c) Assemble the non-return valves, spring and nut on the rear end of the valve seat and secure the nut by its taper pin.
- (d) Insert the control rod in the piston rod and then screw the throttling bush into the front end of the piston rod and secure it by its grub screw.
- (e) Place the joint washer on the control rod, insert the piston and control rods together in the cylinder from the front, screw the control rod home by means of the No. 341 breech mechanism wrench and secure it by its securing screw.
- (f) Place in position from the rear, the piston rod front gland ring, "U" packing ring, centre gland ring, four "V" packing rings, rear gland ring and cylinder gland bush. Tighten the bush with No. 341 wrench.
- (g) Screw the run-out adjusting valve into the front end of the control rod, insert the control rod gland ring, packing and gland nut; secure the valve by the locking plate, bolt and washer.
- (h) Insert the filling and emptying plugs with joint washers and secure them by the wire provided.
- (i) Insert the securing pin in the rear end of the piston rod and secure the pin by its locking pin.

**To mount the buffer.**

- (a) Screw the securing collar part way on the buffer cylinder.
- (b) Place the breech casing at approximately 45 degrees elevation.
- (c) Hold the buffer at right angles to the casing and insert the piston rod securing pin in the lugs on the breech ring.
- (d) Lift the buffer into its housing and secure it to the underside of the breech casing by its supporting bracket, bolts and locking plates.
- (e) Screw the securing collar home, using the No. 341 wrench.
- (f) Secure the collar by the friction disc and grub screw.
- (g) Secure the cover over the piston rod aperture in the casing by its screws.

## SECTION 6

### DETAILED TASKS, TESTS AND ADJUSTMENTS

**81. To gauge the protrusion of the striker.**—See that the breech is closed.

Remove the breech block.

Dismantle the striker, using the firing hole bush key; see the striker housing and striker are clean, and then reassemble.

Apply the No. 25 striker protrusion gauge to the point of the striker, and ascertain whether the protrusion is within the gauge limits. If the protrusion is insufficient, the inside of the firing hole bush will be examined to see that no foreign matter is preventing full protrusion. If the protrusion is still insufficient, or is too great, the striker should be changed.]

Replace the breech block.

## Stoppages

## 82. A.—Feed control lever to the left and gun fails to fire.

Stoppage.	Cause.	Remedy.
Round on tray— Rammer to rear .. ..	Slow loading .. ..	Insert new charger.
Rammer forward .. ..	Broken catch lever spring ..	Remove loose round, and fire at single round. If gun fails to fire, replace broken spring.
	Broken rammer shoe spring	Replace broken spring.
Rammer forward— No round on loading tray, breech open	Jammed feed pawls ..	Unload and release feed pawls.
Breech closed .. ..	Not properly loaded ..	Load properly.
	Missfire .. ..	Carry out missfire drill. If round not struck ascertain cause and correct.
	Broken striker or spring ..	Dismantle mechanism and replace broken parts.
	Insufficient protrusion of striker	Dismantle mechanism and replace striker and / or spring.
	Striker cover incorrectly assembled	Assemble correctly.
Round in chamber, breech not fully closed	Too much grease in chamber	Unload and clean chamber.
	Burred mechanism .. ..	Unload, dismantle mechanism and remove burrs.
	Loose projectile .. ..	Remove round with the hand extractor or ejector.
Round in chamber, breech open	Breech closing spring broken	Unload, replace broken spring.
Round partially loaded or failure to eject	Broken rammer spring ..	Unload, remove automatic loader and replace broken spring.
No round in chamber ..	Broken cylinder catch ..	} Strip automatic loader and replace broken part or parts.
	Broken cylinder catch arm..	
	Broken cylinder catch, torsional spring	

NOTE.—In the event of an extractor breaking, the breech mechanism will jam and may cause damage to other parts.

## B.—Feed control lever to the right and gun fails to fire.

Stoppage.	Cause.	Remedy.
No round on loading tray, rammer forward, breech open, one round in loading pawls	Insufficient rounds in the loader	Unload the round if no more firing. Reload if firing is to continue.
Missfeed—no round brought down on to loading tray	Chargers loaded with bottom round not parallel to top of loader	Push down on rounds; if they do not move, then unload rounds in the loader and reload.
Feed cylinder fails to rotate..	Taper pin out of position ..	Dismantle automatic loader and replace taper pin.

## C.—Premature burst.

Stoppage.	Cause.	Remedy.
In barrel or just outside ..	Obstruction in bore, perforated fuze, worn barrel	Replace the barrel.



**83. To fill the hydraulic buffer.**

- (a) Lay the gun at about 25 degrees elevation.
- (b) Remove the filling hole plug.
- (c) Unscrew the valve adjusting run-out a few turns.
- (d) Insert filling funnel in the filling hole and pour liquid in slowly until it overflows from the filling hole.
- (e) Replace filling hole plug.
- (f) Elevate and depress a few times, finishing up with the gun at the original elevation of 25 degrees.
- (g) Remove filling hole plug and pour in more liquid.
- (h) When completely full, replace the filling hole plug and reset the valve adjusting run-out.

The normal setting of the valve is fully closed and then opened one-third of a turn.

**84. To empty the hydraulic buffer.**

- (a) Depress the gun.
- (b) Remove the filling hole plug.
- (c) Place a receptacle in position and remove the drain hole plug.
- (d) When empty, replace filling and drain hole plugs.

**85. To replenish liquid in buffer.**—Proceed as described under “To fill the hydraulic buffer.”

**86.† To tighten the glands.**—The gland in the front end of the control rod may be tightened with the buffer *in situ*, but it is necessary to remove the buffer before the gland in the rear end of the cylinder can be tightened.

- (a) Remove the buffer by removing the collar set screw, slackening the collar, removing the supporting bracket securing screws and locking plates and the bracket. Lower the buffer through 90 degrees, and remove it from the lug of the breech ring.
- (b) Tighten the gland concerned by means of the special spanner provided.
- (c) Assemble the buffer on the breech casing after connecting the piston rod to the lug of the gun.

NOTE.—When leakage from a gland is persistent and cannot be remedied by the ordinary process of tightening, the only remedy is to repack the gland.

**87.† To replace a recuperator spring.**

NOTE.—The recuperator spring is issued as a component part of the barrel, and normally the barrel and spring are replaced as a unit.

- (a) Remove the barrel, then the flame guard from the barrel.
- (b) Assemble the recuperator spring compressor as follows :—
  - (i) Slide the body over the spring from the front.
  - (ii) Slide the nut over the rear end of the barrel, screw it on to the body by means of the barrel collar wrench until the pressure is taken off the collar on the gun.
- (c) Remove the two set screws from the collar, unscrew the collar with the barrel collar wrench and remove the collar.
- (d) Slide off the spring in the compressor.
- (e) Remove the spring from the compressor as follows :—
  - (i) Assemble the compressor guide from the rear.
  - (ii) Assemble the forcing screw and thrust plate from the front.
  - (iii) By means of the handle, rotate the forcing screw until the pressure is taken off the nut.
  - (iv) Remove the nut.
  - (v) By means of the handle, rotate the forcing screw until tension has been taken off the spring.

- (vi) Continue rotating the handle until the compressor guide is free.
- (vii) Remove the compressor guide, also the spring, with its sleeve and washer.
- (f) **To replace a spring in the compressor :—**
  - (i) Place the sleeve and new spring in the body and the washer on the rear end of the spring, insert the guide and assemble the forcing screw with thrust plate.
  - (ii) By means of a handle, rotate the forcing screw until the spring is compressed sufficiently to replace the nut.
  - (iii) Replace the nut on the rear end of the body and see that it is screwed home by the wrench.
  - (iv) By means of the handle, unscrew the forcing screw until the pressure is taken off the nut.
  - (v) Continue unscrewing until the compressor guide is free.
  - (vi) Remove the compressor guide, forcing screw and thrust plate.
  - (g) Slide the spring in the compressor over the barrel from the front.
  - (h) Secure the washer, spring and sleeve in position on the barrel by the collar, using the wrench ; secure the collar by the two set screws.
  - (i) Dismantle the recuperator spring compressor as follows :—
    - (i) Unscrew the nut from the body and slide it off over the rear end of the barrel.
    - (ii) Slide the body off the spring to the front.
    - (j) Replace the flame guard and then the barrel.

### THE MOUNTING

**88.† Ball bearings and racers.**—Ball bearings should be removed periodically and, together with the racers, cleaned and well greased. Damaged or distorted balls should be replaced.

**89. Trunnion bearings** of the breech casing and balancing gear should be well lubricated and work freely.

**90.† Gun balancing gear.**—Correct balance of the gun should be maintained by adjustment of the nuts on the compressing rods.

To replace a spring, proceed as follows :—

- (a) Open the cover of the spring casing.
- (b) Insert the spring assembling apparatus guard into the slots in the casing.
- (c) Elevate the gun to 90 degrees and secure it.
- (d) Remove the nuts from the compressing rod. (The pressure of the springs is now taken by the guard.)
- (e) Screw the spring assembling apparatus adjusting screw into the end of the compressing rod and insert the connecting pin.
- (f) Rotate the wrench of the apparatus to take the pressure of the springs off the guard.

Remove the guard.

- (g) Unscrew the wrench and remove it from the adjusting screw. The springs are now ready for removal.
- (h) To assemble the springs—reverse the procedure.

NOTE.—Spanner No. 251 is used with the spring compressing rod nuts. Both sets of springs are adjusted when balancing the gun.

**91. Elevating, traversing and receiver gears** should be kept free from grit, dust and well lubricated ; all arcs, pinions, bevel and worm gears, etc., must have the old lubricant removed periodically, and be thoroughly cleaned before applying fresh lubricant.

While lubricating, the gears should be well worked through their full range to distribute the lubricant and test the gears. Special care should be taken to ensure that any oil or grease coming into contact with the "Silentbloc" couplings and rubber sleeve in the traversing gear of the Mark 3 mounting is immediately removed.

**92.† Elevating switch trip gear.**—The lever and cam roller should be kept lubricated.

Correct adjustment for cut-off at elevation and depression should be maintained by means of the cam plate on the breech casing trunnion.

**93.† Traversing power synchronizing gear.**—All working joints should be kept lubricated.

The gear should be periodically checked to ensure that the switch and clutch operate at the same time. Alternatively, the clutch should engage just before the current is switched on, and the current should be switched off just before the clutch is disengaged. Necessary adjustments should be made by means of the nuts on the stop lever operating rod.

**94. Firing gear.**—The bearings, levers and rods on the mounting and in the breech casing should be kept lubricated and the gear frequently checked to ensure correct movement of the firing gear check lever is being maintained.

**95.† Brake gear. Hydraulic type.**—The tank of the master cylinder must be replenished as necessary with the correct fluid; in no circumstances must ordinary lubricating oil be poured into the system.

Inspect all unions, pipes and washers for leaks and damage.

Keep all working parts clean and free from rust.

Take care that no oil or grease reaches brake-drums or friction linings.

Lubricate all bearings and pivots.

**"Bleeding" of the system.**—It is essential that the supply tank of the master cylinder is kept filled. This is most important with the Mark 2 platform to obviate any possibility of air getting into the brake system due to the abnormal position taken up by the cylinder after the wheels and axle have been removed from the platform.

Whenever any part of the system has been disconnected, or a leak has drained the tank of the master cylinder, it is necessary to "bleed" the system to expel all air.

- (a) Fill the tank with fluid and keep the tank well supplied during the whole period of bleeding.
- (b) Attach a drain tube to the bleeder screw of one of the wheel cylinders, slip the special key over the tube to engage the hexagon of the screw, and allow the tube to hang into a clean container, keeping the end submerged in a little fluid.
- (c) Unscrew the bleeder screw one turn.
- (d) Raise the lever operating the master cylinder and allow it to return without assistance. Repeat these operations with slight pauses until all air bubbles cease to appear.
- (e) Carry out this procedure for the other wheel cylinder.

The rope operating the brake gear, when not in use during travelling, should be wound on the hooks with a certain amount of slackness, otherwise shrinkage due to climatic conditions may apply the brakes.

#### To adjust the brakes.

- (a) Raise the wheel clear of the ground.
- (b) Spin the wheel.
- (c) Rotate one of the hexagon-headed cam adjusting bolts, which are to be found behind the cover plate, until the brake shoe prevents the wheel being turned.



Turn the nearside iron bolt in an anti-clockwise direction.

(d) Slacken the adjusting bolt back just sufficient to allow the wheel to revolve freely.

(e) Repeat for each brake shoe.

Brakes should be tested at the commencement of each journey.

All brake defects should be reported immediately.

**96. Sighting.**—Sights are to be handled with great care.

All parts are to be kept clean and working parts well lubricated with clean oil.

The parts of the mounting to which the sights are attached must be absolutely clean and free from burrs.

The sighting gear should not be taken to pieces unnecessarily, and adjustments should not be made by scraping or filing.

† If a sight is taken to pieces for any reason, it must be carefully tested on replacement and, if necessary, adjusted.

**97. Tests and adjustments of Sights, Correctional, Mark 5.**—The sights, when controlled by the stick, move in parallel. Since the majority of shooting will be done with the T.E. cam lever set at "FAR" the vertical and lateral sights should be parallel, in elevation, when the T.E. cam lever is set to this position. The procedure for lining up, given below, will ensure this. At G.C. each layer will, therefore, lay with the target in the centre of his foresight. When the T.E. lever is set to "Maximum," however, for long range fire, the sights will no longer be parallel, and the target will appear slightly below the centre of the layer for lines foresight.

The anti-tank telescopes, when controlled by the cam levers, do not move in parallel. When range and lateral deflection have been applied, therefore, the target will not appear in the centre of each telescope. The layer for line will keep some part of the vertical graticule of the telescope on the point of lay; the layer for elevation some part of the horizontal graticule of his telescope.

Before tests are begun, the following preparations should be made:—

(a) Select a well-defined object at least 1,500 yards distant on which to lay.

(b) Remove the pin securing upper deflector tube and raise the tube.

(c) Open the breech, insert the breech and muzzle peep tubes if available.

(d) Set the elevation cam lever to the "Line-up" position and the lever of the line sight to zero.

(e) Set the aim-off speed indicator to zero and ensure that the locking plungers of the elevation and line sight bars are engaged.

Lay the centre of the bore on the aiming point. If the elevation open sight and telescope are found not to be laid on the aiming point, they will be adjusted in the following manner:—

(a) **Elevation telescope.**

(i) *Adjustment for line.*—Slacken the rear securing screw of the telescope holder and bracket (under side of telescope bracket), adjust the telescope on to the aiming point, and tighten up the securing screws.

(ii) *Adjustment for elevation.*—Slacken off the telescope holder securing screws and move the telescope and holder to the front or rear until it is laid on the elevation laying mark of the aiming point.

Tighten up the telescope holder securing screws.

(b) **Elevation open sight.**

(i) *Adjustment for line.*—Slacken the screws securing the elevation hind sight, adjust the sight on to the aiming point, and tighten up the securing screws.

- (ii) *Adjustment for elevation.*—Slacken the screws securing the elevation foresight, adjust the sight on to the elevation laying mark of the aiming point, and tighten up the securing screws.

Check that the bore is still laid accurately on the aiming point.

- (c) If there is insufficient line adjustment of the elevation telescope and/or elevation open sight, the elevation sight bar may be adjusted as follows :—

Slacken the locking nuts of the adjusting screws of the elevation sight bar.

Adjust the elevation sight bar as necessary by unscrewing one adjusting screw and screwing up on the other one an equal amount. Tighten the locking nuts.

Re-adjust the open sight and telescope as in (a) and (b).

- (d) **Line telescope and open sight.**

- (i) *Adjustment for line.*—Check that the bore is still laid accurately on the aiming point. If the line open sight and telescope are found not to be laid for line on the aiming point, they will be adjusted in the same way as the elevation sight. The adjustment, as in (c) of the previous paragraph, cannot be carried out on the line sights bar owing to the presence of the locking plunger.

- (ii) *Adjustment for elevation.*—Set the elevation cam lever to "FAR." Re-lay so that the elevation sights are again laid on the aiming point. If the line telescope and open sights are found not to be laid on the aiming point for elevation, they will be adjusted in the same way as the elevation sights.

Remove the muzzle and breech tubes.

Lower the deflector tube and secure it.

When using the sight testing target (Fig. 48), it should be set up at about 60 feet from the gun and at right angles to the bore. The top of the target should be horizontal.

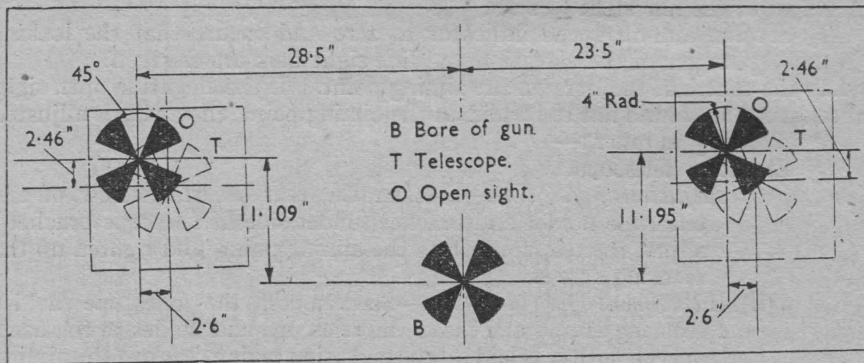


FIG. 48.

**98. Recoil system.**—In action the recoil system should be gauged by results rather than by tests. The recoil should be smooth and the run-out continuous and complete. The following are the faults most likely to be encountered :—

Fault.	Cause.	Remedy.
Recoil violent or excessive ..	Air in buffer .. Insufficient liquid in buffer .. Worn piston rod .. Weak or broken spring ..	Operate filling hole plug. Fill the buffer. Replace by new piston rod. Broken springs (or springs with a permanent set of more than 2 inches below the normal free length) to be replaced.
Recoil, short .. ..	Guides or guideways dry or burred .. Packings too tight .. ..	Keep well lubricated and free from burrs, dirt, grit, etc. Repack.
Run-out, slow .. ..	Burrs, dust or grit on guide-ways .. Incorrect setting of the run-out adjusting valve .. Packings too tight .. Weak or broken spring ..	Remove obstruction. Adjust valve. Repack. Broken springs (or springs with a permanent set of more than 2 inches below the normal free length) to be replaced.
Run-out, violent .. ..	Loss of liquid from buffer .. Air in buffer .. .. Incorrect setting of the run-out adjusting valve ..	Fill the buffer: Operate filling hole plug. Adjust valve.
Failure to run-out .. ..	Run-out adjusting valve closed .. Burrs, grit or dust on guides or guideways .. Packings too tight .. .. Weak or broken spring ..	Open valve. Remove obstruction. Repack. Broken springs (or springs with a permanent set of more than 2 inches below the normal free length) to be replaced.

### †TO CRATE 40-MM. EQUIPMENT

#### 99. General Particulars.

##### (a) Equipment.

- (i) Ordnance ... }
- (ii) Breech casing ... } All Marks.
- (iii) Mounting ... }
- (iv) Platform—Marks 2 and 3 only.

##### (b) Crate—General Details. (See Figs. 49 and 50.)

- (i) Base ... ..
  - 2 Long beams, 1A/5A and 6A/10A.
  - 5 Short cross beams, 1A/10A, 2A/9A, 3A/8A, 4A/7A, 5A/6A.
  - 2 Cross supports (Plane type).
  - 10 Metal angle supports.
- (ii) Sides ... ..
  - 6 Verticals, 2/2A, 3/3A, 4/4A, 7/7A, 8/8A, 9/9A.
  - 4 Diagonals, 3/2A, 4/5A, 7/6A, 8/9A.
  - 1 Cross member O/S.



- |   |                  |     |   |
|---|------------------|-----|---|
| (iii) Ends                                | ...              | ... | 2 Assemblies, A/X, 1/1A-10/10A and 1/N, 5/K-6/M-J/L.  |
| (iv) Top Frame                            | ...              | ... | 2 Long beams, 1/5 and 6/10.<br>7 Short cross beams, F/R, G/P, 5/6, 1/10, 2/9, 3/8, 4/7.<br>1 Short Beam Y/Z.<br>10 Metal angle supports.<br>4 Lifting brackets (ring type).   |
| (v) Internals                             | ...              | ... | 2 Vertical planes, S and T.<br>1 Cross member, W/B.   |
| (vi) Miscellaneous                        | ...              | ... | 8 Long tie bolts.<br>2 Short tie bolts.<br>2 Large "U" barrel brackets.<br>2 Barrel tie hooks.<br>1 Axle tie hook (green).<br>1 Large "U" bracket, EDC (yellow).<br>2 Long axletree tie hooks.<br>2 Small "U" brackets. Sight correctional.<br>2 (Sets of 3) assorted shield clips.<br>Necessary nuts, bolts and washers. |
| (vii) Total weight of crate and equipment | is 3 tons 5 cwt. |     |   |

#### 100. Preparation.

(a) A suitable piece of ground must be selected on which to carry out crating. It must be perfectly flat (not necessarily level), and measure  $5\frac{1}{2}$  yards by 2 yards.

(b) A preliminary check-over of the crate components and tools will obviate delays and inconveniences during the actual crating procedure.

#### 101. Crating Procedure.

(a) Position the 40-mm. equipment on the selected piece of ground, and with the gun secured on the gun stay.

(i) Remove—All covers, less muzzle cover.

Sight, correctional.

Shields.

Barrel.

Traversing and elevating handles.

(ii) Remove locking pins from front and rear axles.

With side extension girders in the travelling position, raise the equipment on the right, left and rear jacks, and wheel the axles and EDC clear of the equipment. Remove the wheels from the axles.

(b) Adjacent to the equipment, assemble base frame less ends 1A/10A and 5A/6A, and crosspiece 2A/9A.

Erect base frame metal angle supports (see Fig. 49).

(c) Slide base frame under equipment, 5A/6A to travelling rear of platform.

(d) Complete assembly of base frame, i.e. :—

(i) Ends 1A/10A and 5A/6A.

(ii) Cross member 2A/9A, with short cross tie rods in position.

(e) Lower equipment on to base frame.

(f) Secure short green tie rods over front longitudinal girder.

(g) Assemble vertical members 3/3A and verticals 7/7A-8/8A with cross member OS.

(h) Secure tool and spare parts boxes, and barrels.

(j) Assemble vertical 4/4A, verticals 5/5A-6/6A, with end frame I, J, K, L, M, N, and verticals 1A/10A with cross member AX.

(k) Assemble cross members Z and Y, and all diagonals.

(l) Position sight correctional adjacent to elevation gears, with transverse sight bar uppermost. Support sight temporarily with canvas covers, etc.

- (m) Assemble crate top, securing all diagonals and tops of verticals.
- (n) Secure sight correctional to the top by the two small "U" brackets R and Q. Remove the temporary supports (sub-para. (1) refers).
- (o) Secure the two halves of the shield to the verticals 2/2A and 9/9A by means of brackets at E and T and clips at 2 and 9.
- (p) Position EDC with front axle attached over front longitudinal girder. Pass cross member DU through lifting handles of EDC and secure together by large yellow "U" bracket. Secure cross member DU to top frame. Secure axle by two white tie hooks.
- (q) Erect :—
- (i) End frame AX/10/10A/1/1A between verticals 1/1A and 10/10A.
  - (ii) Vertical 1Z.
  - (iii) All long tie rods (Coloured :—black, white, blue, brown, green and yellow).
- (r) Attach gun wheels to diagonals 1/10A, 10/1A, 4/5A and 7/6A, and ammunition holder and spare wheel to vertical 1Z.
- (s) Stow auto-loader cover under gun stay. Secure maul to vertical T, and secure latter to cross member 4/7 adjacent to 7.
- (t) Secure rear travelling axle to frame JL by green tie hook.
- (u) Secure carrier drum and cable to top frame (GP) adjacent to traversing gears.

Attach vertical S to top frame cross member 4/7 adjacent to 7.

Secure to S, auto-loader side levers and gear guide.

(w) Stow cleaning rods and elevating and traversing handles in "Action" cover, and lash to carrier drum and cable by means of a drag rope.

(x) Place all tools remaining in holdall, and, with barrel support blocks, stow under auto-loader cover. Lash the latter firmly in position by means of a drag rope.

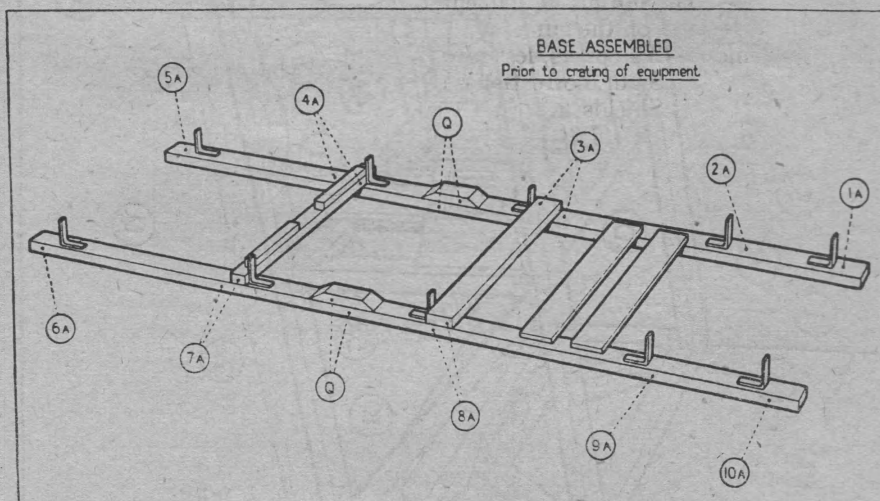


FIG. 49.

### 102. Uncrating Procedure.

- (a) Unlash auto-loader and take out holdall. Tools should be available.
- (b) Detach auto-loader parts and vertical S from cross member 4/7-4A/7A.
- (c) Detach maul and vertical T from cross member 4/7-4A/7A.
- (d) Unlash "Action" cover from carrier drum and cable, and remove together with elevating and traversing handles and cleaning rods.

CRATE ASSEMBLED WITHOUT EQUIPMENT.

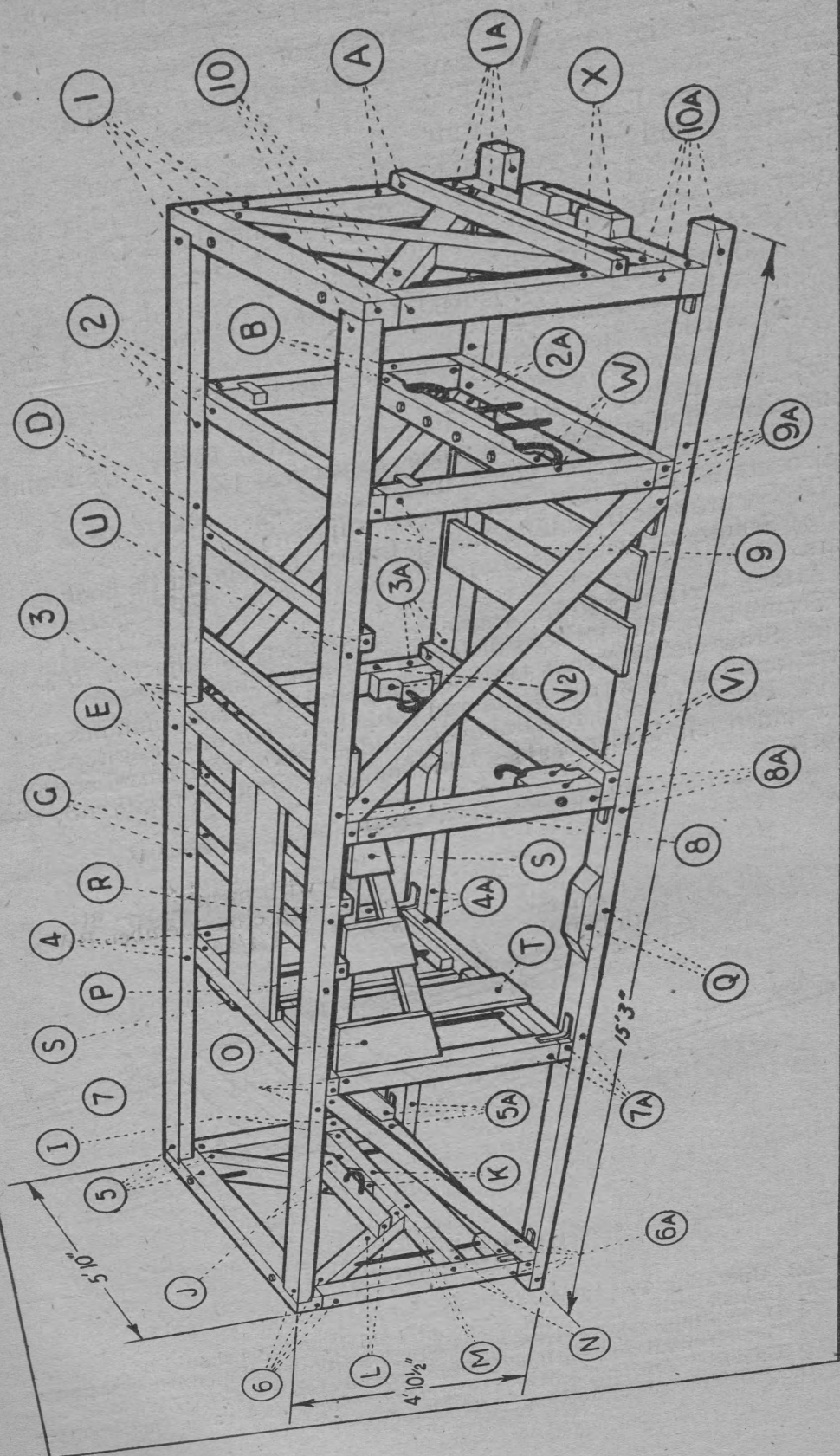


FIG. 50.



- (e) Detach carrier drum and cable from top frame member GP.
- (f) Detach gun wheels from diagonals 1/10A, 10/1A, 4/5A, 7/6A, and spare wheel and ammunition holder from vertical 1Z.
- (g) Release green tie hook on cross member JL and lift rear travelling axle clear.
- (h) Remove :—
  - (i) All long tie rods (coloured :—black, white, blue, brown, green and yellow).
  - (ii) Vertical 1Z.
- (j)—(i) At 1, 5, 6 and 10, remove the two lower bolts on the vertical member at the metal angle support and slacken the upper bolt.
- (ii) At 1A, 5A, 6A and 10A, remove the two upper bolts on the vertical member at the metal angle support.
- (k) Remove both ends of the crate.
- (l)—(i) Disconnect large yellow " U " bracket from cross member D/U.
- (ii) Release D/U from top frame and withdraw cross member from EDC.
- (iii) Release the two white tie hooks from axle, and remove EDC and axle from crate.
- (m) Release shields from verticals 2/2A and 9/9A ; remove shields.
- (n) Disconnect top frame, *i.e.* :—
  - (i) At 2 and 9 remove the two lower bolts on the vertical member.
  - (ii) At 3, 4, 7 and 8 remove the three lower bolts on the vertical member.
  - (iii) Remove all diagonals.
- (o) *Support sight correctional with canvas covers, and disconnect small " U " brackets R and Q.*
- (p) Lift top frame clear of crate.
- (q) Lift out correctional sight and remove temporary supports (sub-para. (o) refers).
- (r) Release " U " brackets at W and B and tie hooks at V and X, and lower the barrels.
- (s)—(i) Remove verticals 7/7A and 8/8A with member OS attached.
- (ii) Remove verticals 2/2A and 9/9A with cross member BW attached.
- (iii) Remove remaining verticals 3/3A and 4/4A.
- (t) Remove both barrels, and tool and spare part boxes.
- (u) Release the short green tie rods securing front longitudinal girder.
- (v) Raise equipment on right, left and rear jacks.
- (w) Remove :—
  - (i) Ends 1A/10A and 5A/6A.
  - (ii) Cross member 2A-9A with short green tie rods.
- (x) Slide base frame clear of equipment.
- (y) Re-assemble wheels to axles and axles with EDC to platform. Lower equipment on to wheels and complete re-assembly of equipment.

## SECTION 7

### AMMUNITION

#### General

**103.** The ammunition (Fig. 51) used with this equipment is of the fixed Q.F. type, *i.e.* the shell is fixed into the mouth of the cartridge case, and comprises a propellant charge in a cartridge case, primer, projectile, tracer and fuze, all of which are issued, stored and loaded together as one complete round.

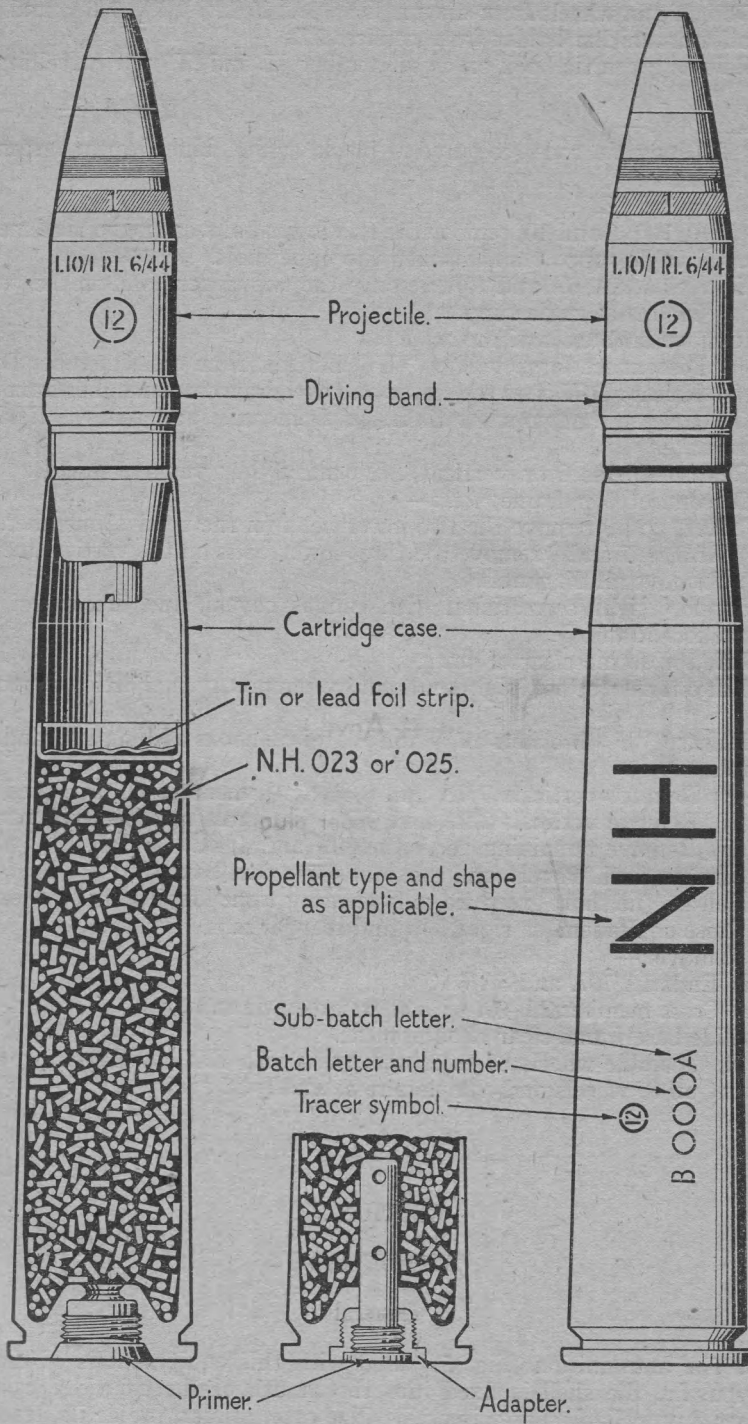
CARTRIDGE.

FIG. 51.

10  
quan  
cartr  
used  
char  
1  
prim  
scre

**104. The propellant charge.**—A typical propellant charge consists of a quantity of cordite in stick form, tied up with silk ties and placed inside a cartridge case. The weight of the charge varies with the type of cordite used, *i.e.* W.T., N.C.T., W.M.T., N.H., N.Q. Tin foil is placed with each charge. Its object is to prevent the coppering of the gun.

**105. Primer, Percussion, Q.F. Cartridge, No. 12, Mark 3** (Fig. 52).—The primer consists of a body, cap, anvil, plug, screwed plug and magazine, and is screwed into the base of the cartridge.

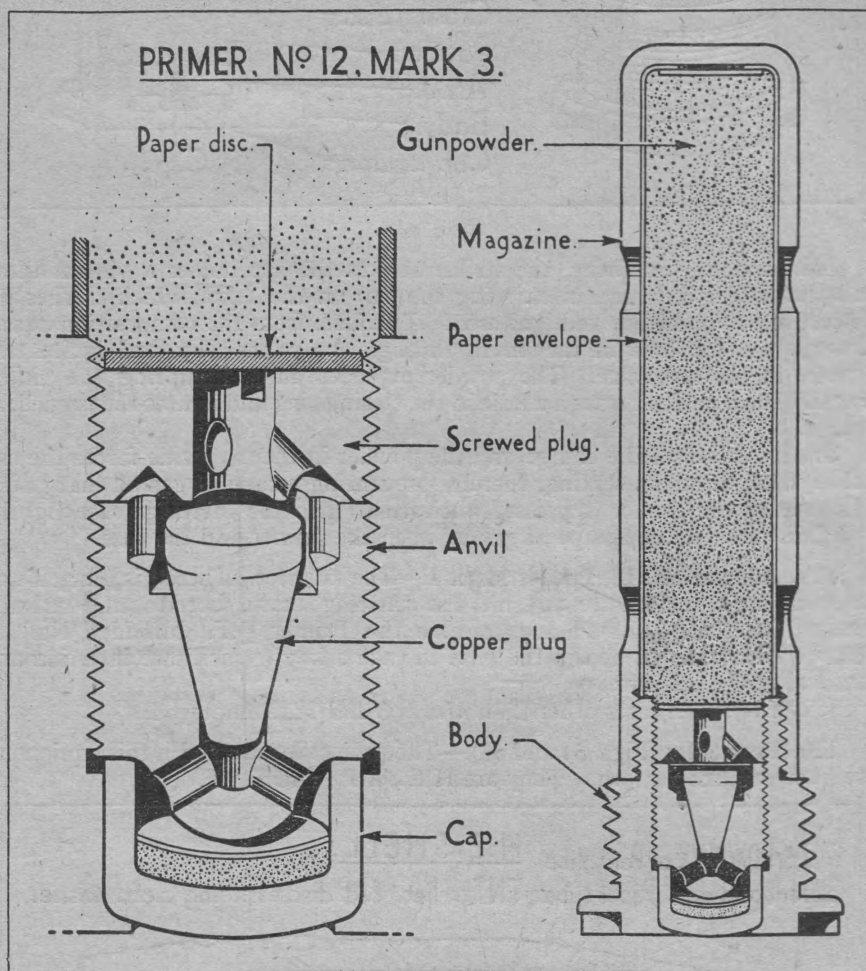


FIG. 52.

**106. Action.**—On firing, the firing pin of the striker strikes the cap a violent blow which crushes the mixture on to the anvil and ignites it. The flash passes through the fire channels in the anvil and screwed plug to ignite the gunpowder in the magazine. The gunpowder explodes, and the flash passes through the holes in the magazine and ignites the propellant charge. The explosion of the charge and magazine forces the copper plug into the coned seating in the anvil, thereby closing the fire channels and preventing the escape of gas at this point. The walls of the primer are pressed outwards to grip the cartridge case tightly, and prevent gas escape between primer and case.



**107. Primer, Percussion, Q.F. Cartridge, No. 18, Mark 1** (Fig. 53).—The primer consists of a body, cap holder, cap, anvil, closing ring and closing disc.

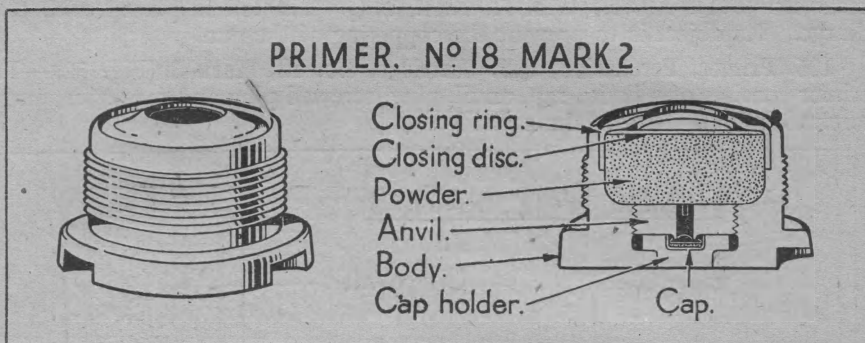


FIG. 53.

**108. Action.**—On firing, the striker strikes the cap holder a violent blow, and the holder is forced in carrying the cap on the anvil, which crushes the detonating composition and ignites it. The flash from the composition passes through the fire hole in the anvil, through the paper disc, and ignites the powder in the magazine. The powder explodes and, disrupting the tinfoil disc, the flash passes through a hole in the closing ring and ignites the propellant charge.

The explosion of the charge and the powder in the magazine forces the cap holder back on to its seating, thereby preventing escape of gas at that point. The wall of the primer is pressed outward to grip the cartridge case tightly, and thus prevent the escape of gas between the primer and the case.

**109. Adapter No. 12, Primer Mark 1.**—The adapter, of steel, is flanged and screw-threaded externally to suit the cartridge case, bored out centrally recessed and screw-threaded to receive the Primer Q.F. Cartridge No. 12. Three recesses are formed in the base to take a key to facilitate insertion and removal of the adapter.

It is used when cases other than *Marks 3 and 4* are employed.

**110. Projectiles** (Figs. 54 and 55).—The projectiles used with this equipment are of streamline pattern. They are H.E., A.P., and S.A.P.

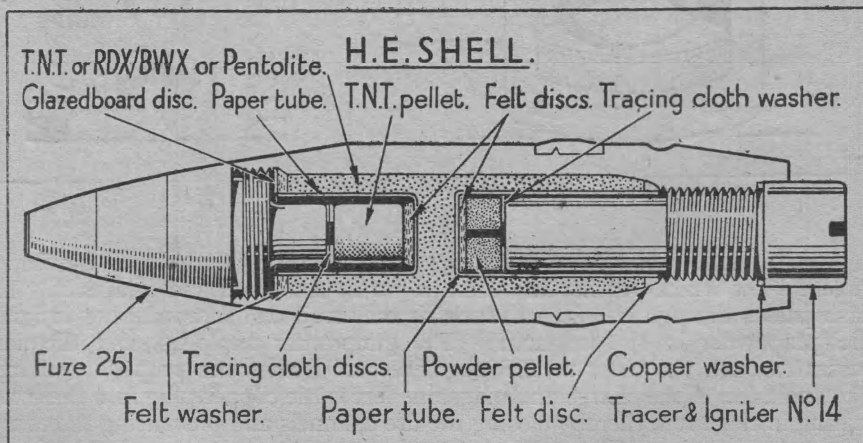


FIG. 54.

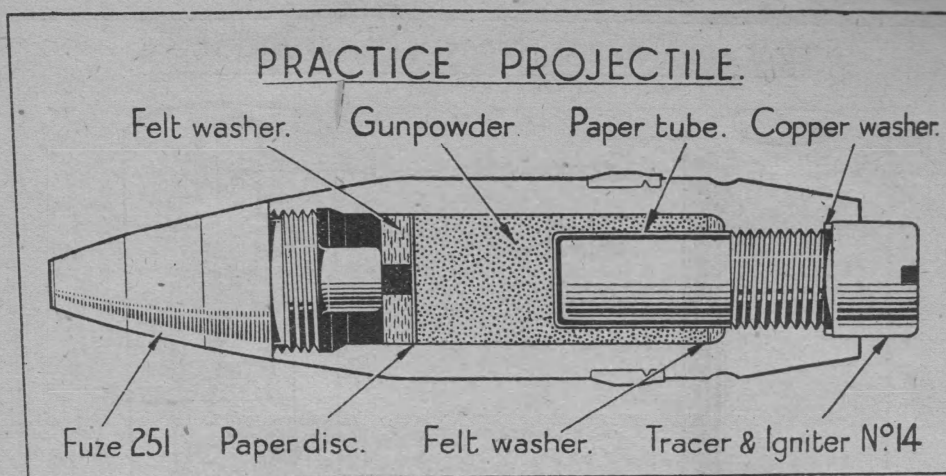


FIG. 55.

Projectiles are painted primarily to preserve the bodies from rust. Advantage is taken of this to indicate, by the colour employed, the nature of the filling, thus:—H.E. shell are painted yellow. In addition, certain other identification markings are painted on the shell.

The **Mark 6T high explosive shell** may be filled, T.N.T., Pentolite, or RDX/BWX with a No. 251 and 255 percussion D.A. fuze and a No. 11, 12 or 14 tracer (Fig. 56) and igniter. The bursting charge has a recess at each end. The upper recess accommodates the magazine portion of the fuze and an exploder pellet, while the lower recess receives the tracer igniter and the powder pellet, which brings about self-destruction of the projectile when ignited by the tracer composition.

The **Marks 2T and 4T** shell are generally similar to the **Mark 6T**. The **Marks 5T and 7T** shell are generally similar to the **Marks 4T and 2T** respectively, differing principally in having gilding metal driving bands.

**111. Fuze, Percussion, D.A. No. 251** (Fig. 57).—The Mark 3, No. 251, D.A. percussion fuze consists of the following principal parts:—

Body, magazine, head, striker guide, arming spring, arming sleeve, stirrup spring, ferrule, pin, needle, hammer cover plate, detonator plug, detonator pellet retaining plug, pellet spring, locking collars, stemmed plug, shutter, shutter ferrule, stirrup spring, washer and detonator.

The body is in two parts, Parts I and II.

**112. Action.**—On the shock of discharge:—

- (i) The ferrule in the body, Part I, sets back and takes the stirrup spring with it, thereby releasing the arming sleeve, which is forced upwards by its spring and unmasks the three holes in the striker guide.
- (ii) The shutter ferrule sets back on to the lead washer, and takes the stirrup spring with it, thereby releasing the shutter.

During flight:—

- (i) The three steel balls fly outward under centrifugal force and release the needle.
- (ii) The two parts of the shutter separate and fly out under centrifugal force.

The detonator pellet is forced downward by its spring and is retained by the locking collar, the halves of which fly outward under centrifugal force into the annular recess in the body, Part II.

# TRACER AND IGNITER, SHELL, N°14. MARK 3.

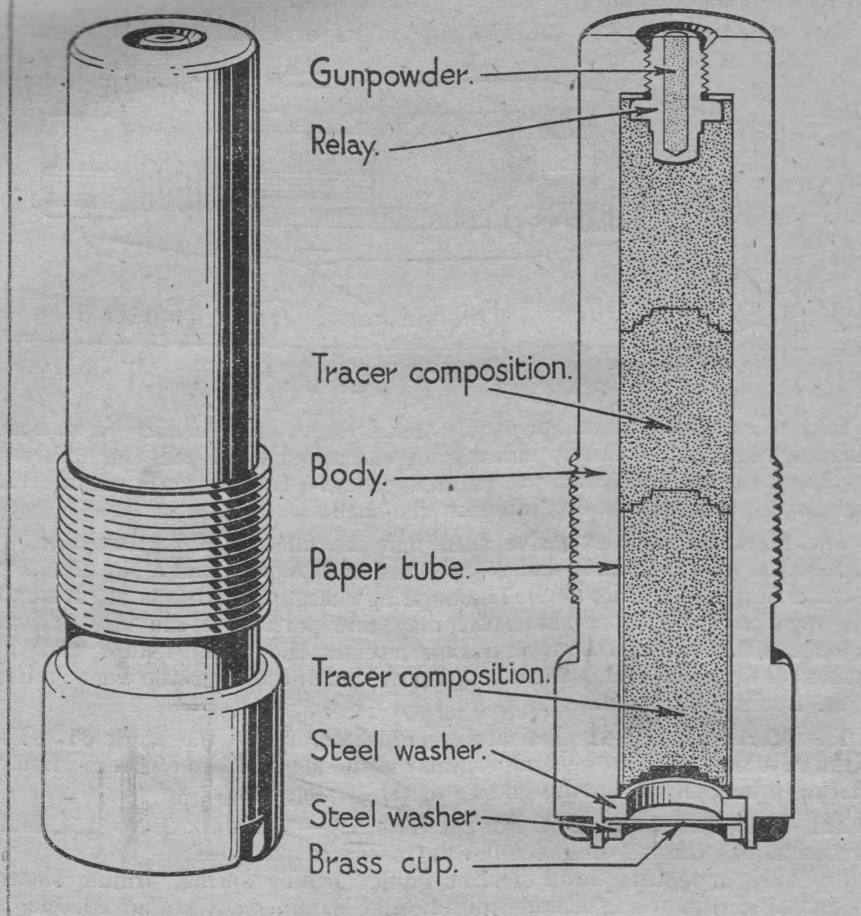


FIG. 56.

## On impact :—

The cover plate and hammer are forced in and the hammer drives the needle into the detonator, which is fired. The flash ignites the lead azide and C.E. in the detonator pellet ; the explosion blows out the thin disc of metal and fires the C.E. in the stemmed plug, resulting in the detonation of the C.E. pellet in the magazine. This detonates the T.N.T. exploder and bursting charge in the shell.

**Safety Arrangements.**—The fuze cannot be fired until the two ferrules set back to release the arming sleeve and shutter respectively ; this takes place on firing.

The three balls prevent the striker engaging the detonator until the balls fly outwards under centrifugal force, and the shutter prevents any flash from the detonator pellet firing the C.E. in the stemmed plug until the halves of the shutter fly outwards under centrifugal force. Centrifugal force takes place when the shell is in flight.



### FUZE, PERCUSSION, D.A. N° 251, MARK 3.

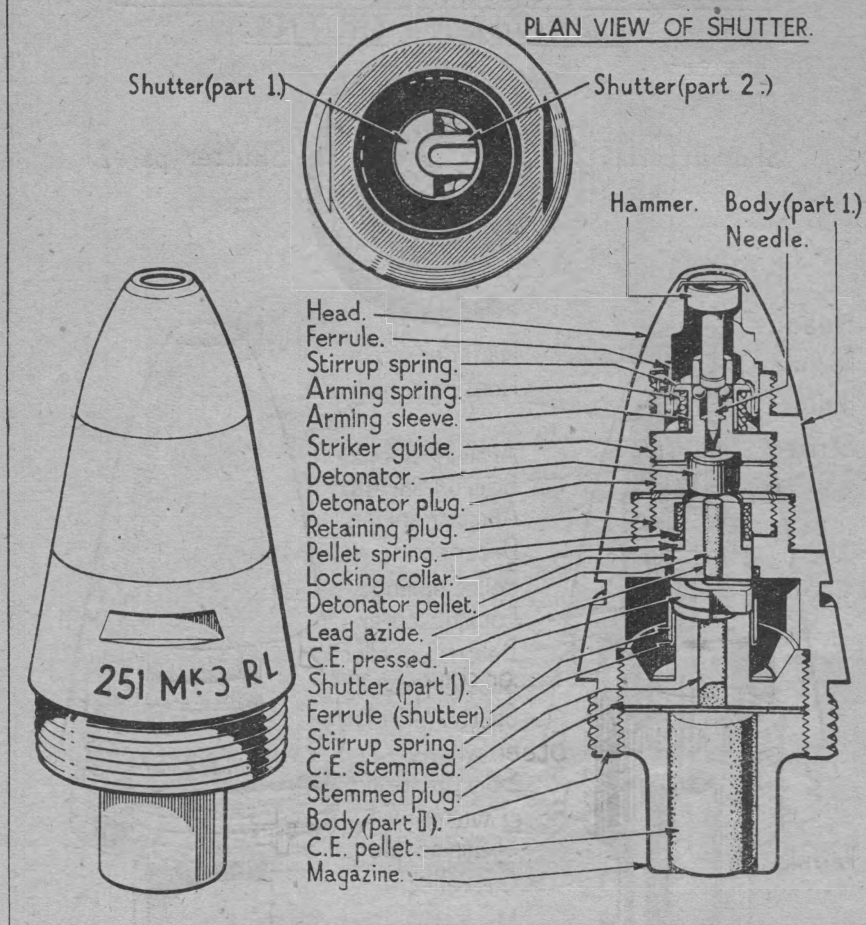


FIG. 57.

**113. Fuze, Percussion, D.A. No. 255** (Fig. 58).—The Mark 1A Fuze, Percussion, No. 255, is generally similar to the No. 251 Fuze, differing principally in being filled delay.

#### **114. List of Ammunition Packages**

No. of Box.	Contents.	Dimensions.	Weight (approx.).
C. 216 (Steel)	.. 24 rounds in 6 chargers	20.6 ins. × 7.75 ins. × 10.45 ins.	35-lb., empty. 155-lb., filled.
C. 219 (Steel)	.. 24 rounds, each in container No. 6	20.6 ins. × 7.75 ins. × 10.45 ins.	32-lb., empty. 165-lb., filled.
B. 167A	.. 9 rounds, each in container No. 226	21.8 ins. × 9.5 ins. × 9.35 ins.	14-lb. 9-oz. empty, 65-lb., filled.
C. 229 (Wood)	.. 250 chargers (aluminium)	33.25 ins. × 22.75 ins. × 12.25 ins.	307-lb., filled.
C. 230 (Wood)	.. 50 chargers (aluminium)	15.5 ins. × 10.75 ins. × 10.6 ins.	65-lb., filled.

**FUZE, PERCUSSION, D.A. N° 255 MkI.**  
PLAN VIEW OF SHUTTER.

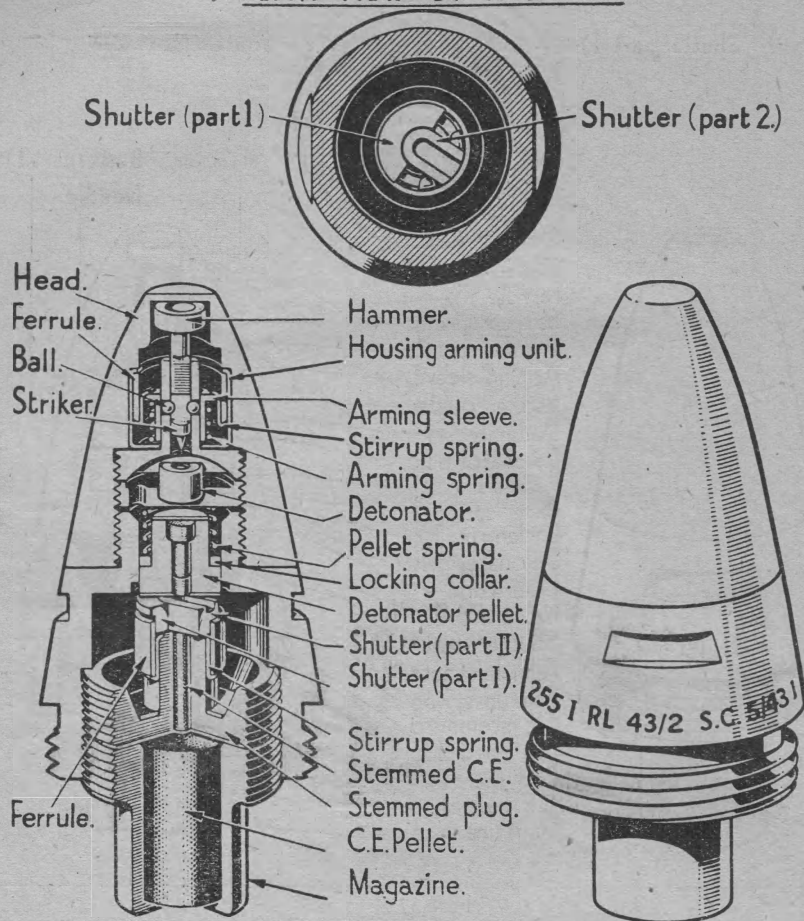


FIG. 58.

**Markings on Ammunition**

(Figs. 59 and 60)

**115. Ammunition is marked** to facilitate identification and ensure correct segregation in store and during transit. The markings on the filled round are as follows :—

**116. Cartridge Case**

**Stampings on base :—**

- (a) Calibre of gun.
- (b) Mark of empty case.
- (c) Manufacturer's initials or recognized trade mark.
- (d) Date of manufacture.

- (e) Lot number of case.
- (f) Monogram and annealing series number when the case has been low-temperature annealed.
- (g) The letter C, followed by an F for every time the case has been filled with a FULL charge.
- (h) The letter C, followed by an R for every time the case has been filled with a REDUCED charge.
- (i) The letter F or R barred out thus,  $\overline{F}$  or  $\overline{R}$ , for every time the case has been filled but not fired, with either full or reduced charge respectively.
- (j) The letter S after the numeral denotes that the case has been repaired by re-bushing the primer hole.

**Stencilling on the side of the case :—**

- (a) BATCH followed by the batch letter and number as applicable, and then, if necessary, a sub-batch, letter, *e.g.* BATCH B21A.  
Cartridges of Canadian manufacture can be identified in that the letters "CAN" appear with the Batch number, *i.e.* CAN B21A, also CR/C or PG/C, the monograms of the two Canadian filling plants, appear on all boxes and cartridges.
- (b) "R" denotes reduced charge.
- (c)  $\overline{T}$  denotes Tracer is fitted.
- (d) Nature and shape of the propellant; *e.g.* W.T., denotes cordite, W, tubular.

The stencilling is with silver nitrate, the letter R in 1-in. type, remainder in  $\frac{1}{4}$ -in. type.

**117. Projectiles**

**Stampings.**—On body of shell above the driving band :—

- (a) Calibre and Mark.
- (b) Manufacturer's initials or recognized trade mark and date of manufacture (month and year).
- (c) Lot number of empty shell.
- (d) Manufacturer's code letter and cast-number.
- (e) B.S. if machined from bar steel.

**Painting :—**

- (a) Shell filled H.E. painted buff.
- (b) Semi-armour-piercing shot are painted black with a white tip, and with a red ring in addition if fitted with tracer.
- (c) Armour-piercing shot are painted black with a white tip and a white ring. A red ring in addition denotes that a tracer is fitted.
- (d) Practice projectiles are painted black with a yellow ring.

**Markings :—**

- (a) A light green ring round the body above the shoulder, with the letters T.N.T. on the green ring or immediately below it, indicates T.N.T. filling.
- (b) A blue ring round the body above the shoulder, with the figure 1 stencilled on the blue ring, indicates R.D.X/BWX 91/9 filling.
- (c) A green/black/green ring round the body above the shoulder, with PEN/D1 stencilled on the black ring or immediately below the lower green ring, indicates Pentolite filling.
- (d) A yellow ring on a black body indicates practice projectile.
- (e) A white tip indicates S.A.P. shot.
- (f) A white tip and a white ring indicate A.P. shot.



# MARKING ON PROJECTILES.

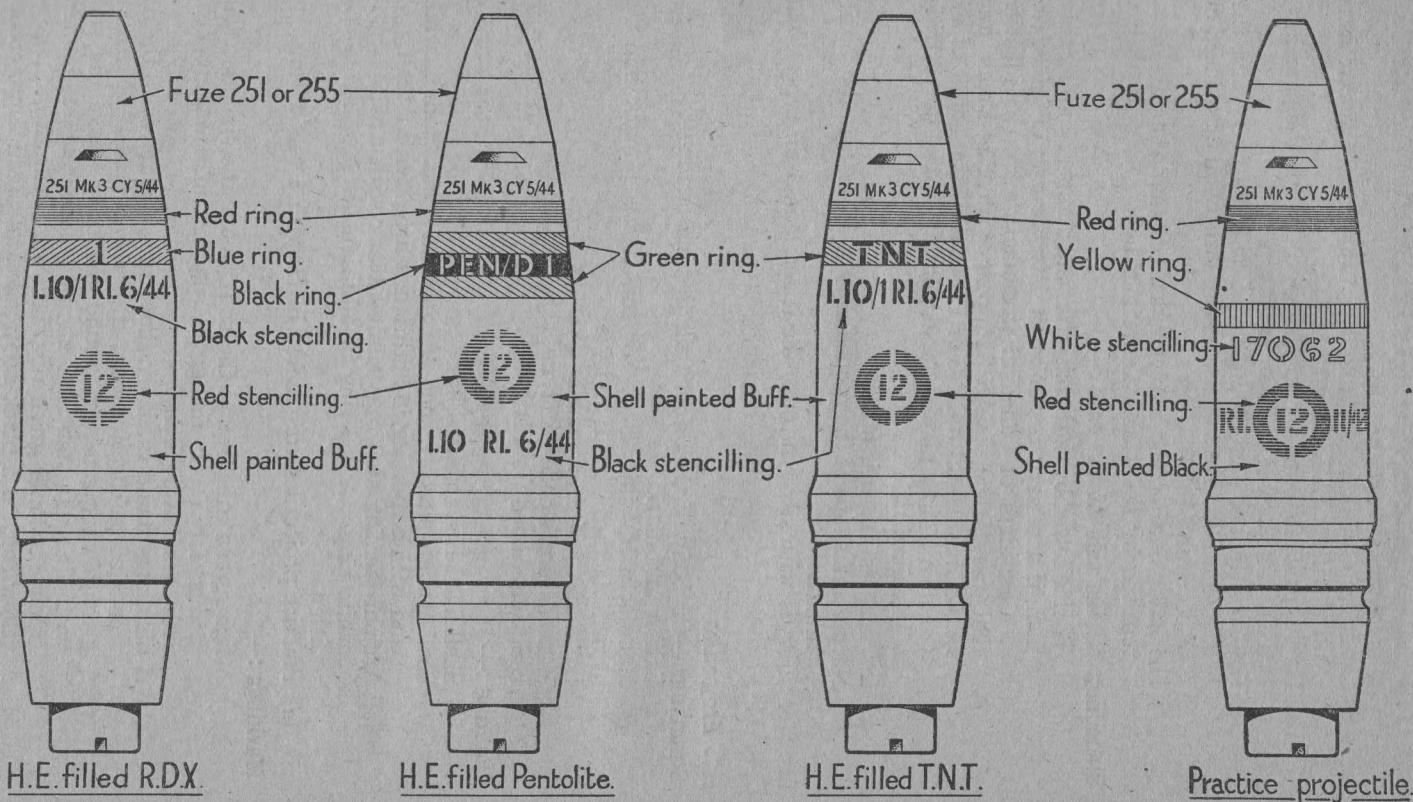


FIG. 5

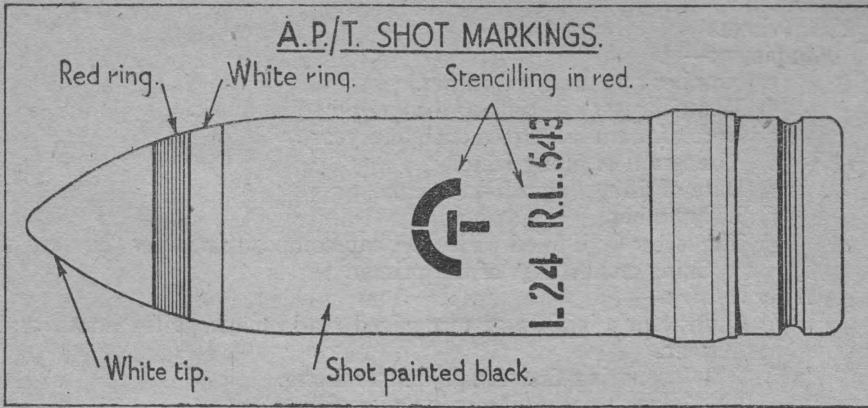


FIG. 60.

- (g) A red ring on a shot indicates fitted with filled tracer.
- (h) A brown ring on nose indicates projectile is made of cast iron.
- (i) Shot prepared for, or fitted with, tracer :—  
 (—) in red, when prepared for tracer.  
 (T) in red, when fitted with tracer.
- (j) Shell prepared for, or fitted with, tracer and igniter :—  
 (C) in red, when prepared for tracer and igniter.  
 (C) in red, with figure 7 in circle when fitted with Tracer and igniter No. 11, or figure 12 when fitted with Tracer and igniter No. 14. Figure in circle denotes time in seconds to self-destruction.
- (k) A number in a circle in black to indicate filled shell series number.
- (l) Type number, indicating method of filling design, monogram of filling factory, date of filling (month and year), e.g. :—  
 L 10GD 645

NOTE.—Shell filled before April, 1945, bear design number, e.g. 11606 instead of type number.

- (m) A plain red ring round the head of H.E. shell denotes that the shell is filled with explosive and suitable for world-wide usage.
- (n) A ring of alternate bars and crosses in red,—X—X—X—, denotes that the shell is filled with explosive and has a limited life in tropical climates.
- (o) A hatched ring in red, // // // // denotes that the shell is filled with explosive, and use is restricted to temperate climates only.

NOTE.—For shell filled before April, 1945, and bearing design number instead of Type number, as at para. (l) above, the following details apply instead of paras. (m) and (n) above :—

- (i) A plain red ring indicates that H.E. shell is filled with explosive, and use restricted to temperate climates only.
- (ii) A ring of red crosses indicates that shell is filled with explosive and suitable for world-wide usage.
- (p) On H.E. shell, the particulars of the gaine, i.e. the number, Mark and Lot number (when a separate gaine is used).
- (q) EXPDR. C.E. (when C.E. exploder is in use).
- (r) If the exploder is not shown on H.E. Shell, a T.N.T. exploder is indicated.

**118. Primers****Stampings :—**

- (a) Number and Mark of primer.
- (b) Manufacturer's initials or recognized trade mark.
- (c) Date of manufacture (month and year).
- (d) Monogram of filling factory.
- (e) Date of filling (month and year).
- (f) Lot number.
- (g) The letter Q, if filled with Q.F. cap composition, after the date of filling on the base of the primer.

**After repair :—**

- (h) Contractor's initials or recognized trade mark, with month and year.
- (i) " M " denoting first repair and re-filling.
- (j) " R " denotes second repair and re-filling.

With the MR primer, a circular recess may be cut to accommodate marking.

**119. Fuzes****Stampings :—**

- (a) Number and Mark of fuze.
- (b) Manufacturer's initials or recognized trade mark.
- (c) Year of manufacture.
- (d) Initials of filling firm or monogram of filling station.
- (e) Date of filling (month and year).
- (f) Filled lot number.

No colour markings have been used on fuzes.

**120. Tracers and igniters****Stampings :—**

- (a) Number and Mark.
- (b) Manufacturer's initials or recognized trade mark.
- (c) Date of manufacture.
- (d) Initials of filling firm or monogram of filling station.
- (e) Date of filling (month and year).
- (f) Filled lot number.

**121. Labels on Ammunition Boxes.**

(a) Government explosive and classification label No. L 1606 (Group V 1), or as applicable on lid.

- (b) Two Station labels, sealing lid.
- (c) Packing label No. L 566A on cradle in box at one end.
- (d) Batch label No. L 97 on cradle in box at other end.

**Boxes—on ends and sides.**—(a) Batch letter, number and sub-batch letter as applicable.

- (b) Calibre and nature of projectile as applicable, e.g. 40-mm. H.E.
- (c) Fuze number.
- (d) Filler's initials and lot number of filled fuze.

*On ends only.*—T.N.T. or nature of filling of shell.

**Care and Preservation.**

**122.** Care and preservation of ammunition are given in detail in a pamphlet issued to R.A. units, entitled " Notes on the Care and Preservation of Ammunition and Explosives in the Field, Part 1, Artillery Ammunition." The following instructions are based on this pamphlet :—

**123.** The design and manufacture, packing and issue to the service of ammunition are carefully carried out, therefore the user must give it a reasonable amount of care, protecting it from water, rain, damp, the direct rays of the sun, whether in or out of the service package.



**124.** Transport of ammunition should be carried out in covered vehicles whenever possible. Loads in open vehicles should be covered by tarpaulins. When packages have been exposed to wet in transit, they should be examined, and those containing water, together with their contents, wiped thoroughly dry and carefully re-packed.

**125.** The stacking of ammunition should be, if possible, under cover, a shelter, building or a tarpaulin. The stacking arrangements should allow for the circulation of air around and over the packages. Unboxed rounds should be laid on battens arranged in such a way that each layer is separated and sagging of the rounds is prevented.

**126.** Ready-use ammunition should be kept to a minimum required for operational needs, as ammunition keeps best in service packages. They must be kept dry, clean, free from oil, and protected from the direct rays of the sun.

**127.** The primer should be flush with, or slightly below, the surface of the cartridge case. If it is above, an attempt should be made to screw it home, using the appropriate key for the purpose. If it cannot be screwed home, it should be removed and replaced by another, taking care to luting the under part of the flange and the threads.

**128.** The cartridge case must be clean, dry and free from oil, dents or fluting. Small cracks near the mouth can be disregarded, but cracks elsewhere cause rejection, as they would lead to chamber damage if fired.

**129.** Projectiles should be clean, dry, and free from oil. The driving band should be inspected and, if found seriously damaged, the projectile should not be used. Projectiles are covered with a protective coating of paint, and any found with the paint damaged should be painted at those places with lead-free mineral jelly in order to restore the protective coating.

## SECTION 8

### MISCELLANEOUS DATA

<b>130. Angle of traverse...</b>	...	...	...	360 degrees.
One turn of handwheel (Intermediate Speed)	...	...	...	13 degrees 8½ mins.
One turn of handwheel (High Speed)	...	...	...	17 degrees 9 mins.
<b>Angle of depression (Maximum)</b>	...	...	...	5 degrees.
When fitted with elevation switch trip gear	...	...	...	2 degrees.
<b>Angle of elevation (Maximum)</b>	...	...	...	90 degrees.
When fitted with elevation switch trip gear	...	...	...	87 degrees.
One turn of handwheel	...	...	...	4 degrees 1 min.

#### Gun

##### Barrel—

Weight of barrel	...	...	...	227 lb.
Weight of barrel with recuperator spring	...	...	...	286 lb.
Weight of barrel with breech ring and breech mechanism	...	...	...	423 lb.
Weight of breech casing without auto-loader	...	...	...	350 lb.
Weight of auto-loader with loading tray	...	...	...	215 lb.
Calibre	...	...	...	1.5748 ins.
Capacity	...	...	...	186.6 cu. ins.
Length	...	...	...	88.578 ins.

**Chamber**

Capacity	...	...	...	...	...	28·37 ins.
Length	...	...	...	...	...	12·496 ins.
Taper	...	...	...	...	...	0·035 in.

**Rifling**

Length	...	...	...	...	...	76·084 ins.
System	...	...	...	...	...	Polygroove. Plain Section.
Twist (R.H.)	...	...	...	...	...	Increasing—1 turn in 45 calibres at the breech to 1 in 30 at the muzzle.

**Grooves**

Number	...	...	...	...	...	16.
Depth	...	...	...	...	...	0·0236 in.
Width	...	...	...	...	...	0·22 in.
Firing mechanism	...	...	...	...	...	Percussion.

**Recoil system**

	...	...	...	...	...	Hydraulic Buffer and Spring recuperator.
Quantity of liquid	...	...	...	...	...	1·1 pints approx.
Normal free length of spring	...	...	...	...	...	39 ± 1 in.

**Speed—Cruising (Maximum)**

...	...	...	...	...	...	20 m.p.h.
-----	-----	-----	-----	-----	-----	-----------

**Sights**

...	...	...	...	...	...	No. 5 and 5/1 Sights, Correctional.
-----	-----	-----	-----	-----	-----	--

**Telescopes**

...	...	...	...	...	...	Telescope, sighting— No. 22C, Marks 2 and 3 No. 22D, Mark 1
-----	-----	-----	-----	-----	-----	---

**Tyres, pressures and sizes**

Mountings, 40-mm. A.A., Mark I, on Platform, 40-mm. A.A. Mtg., Mark 1	}	Wheel Nos. 10, 11, 21 and 22.
		Size 6·00 × 20.
		Pressure, 33 lb. per sq. in.
Mountings, 40-mm. A.A., Mark 3 or 4 on Platform, 40-mm. A.A. Mtg., Mark 1	}	Wheel Nos. 10, 11, 21 and 22.
		Size 6·00 × 20.
		Pressure, 38 lb. per sq. in.
Mounting, 40-mm. A.A., Mark 3 or 4 on Platform, 40-mm. A.A. Mtg., Mark 2, 3 or 4	}	Wheel Nos. 73, 74, 75 and 76.
		Size 9·00 × 13.
		Pressure, 22 lb. per sq. in.

## APPENDIX 1

## ORDNANCE, Q.F. 40-MM., MARK I\*

on

## MOUNTINGS, 40-MM. A.A., MARKS 5 AND 5/1

and

## PLATFORM, CARRIER, MORRIS, 40-MM. A.A., MARK 1

1. The above equipment is self-propelled, and is a dual purpose weapon ; it may be used as an anti-aircraft or an anti-tank weapon.

2. **Ordnance.**—The Mark 1\* gun is described in Section 1 of this manual.

3. **Mounting.**—The **Mark 5 mounting** is the Mark 4 mounting converted and adapted for use with the Platform, Carrier, Morris, 40-mm. A.A., Mark 1.

The conversion consists of two new shield brackets and two new shields of different design from those of the Mark 4. The frame has also been modified and footrests removed. The firing platform has been modified to take two ammunition boxes, one on each side.

A special seat has been fitted to the top of the back of the left-hand seat to give a higher sitting position for use with the Mark 5 correctional sight.

The low speed indicator has been removed, together with its shaft.

There are also some differences in manufacturing details of various parts.

4. The **Mark 5/1 mounting** is the Mark 5 mounting with all the power control fittings removed and operated entirely by hand.

The **Mark 4 mounting** is described in Section 2 of this manual.

## 5. Platform

**Carrier, Morris, 40-mm. A.A., Mark 1**

The chassis used for this carrier is the Morris Commercial C9/B, 30 cwt.,

4 × 4.

Four jacks are fitted, one at each side, one at the front or gun stay end and one at the rear or bonnet end, so that the carrier may be raised clear of the ground when action with base plates is ordered. The jacks are swung into the action position and clamped. The cones and base plates are carried two on each side of the vehicle when not in use. When ordered to be used, one is placed beneath each jack, and the jacks are operated until the pads are resting on the cones. When all pads are resting, each jack is given six complete turns and the hand-wheel is locked.

6. The **gun stay** is used for two purposes :—

(1) To secure the barrel in the horizontal rear position when not in use.

(2) To act as a lever for locking the rear axle solid to the chassis frame, if necessary, before firing the gun.

7. The platform base plate is secured to the cross members of the chassis, and an all-round traverse is provided.

8. The traversing power synchronizing gear, provided to declutch the oil unit motor when traversing by hand, is operated by a foot pedal at the rear of the mounting.

9. For instructions regarding the maintenance, controls, tasks and vehicle lubrication chart for the chassis 30-cwt. C9/8, reference should be made to the "Drivers' Handbook" series, Book No. 100/M.L., 1B, one of which is issued to each vehicle ex C.O.D., Chilwell.



## APPENDIX 2

## ORDNANCE, Q.F. 40-MM., MARK 1\*

on

## MOUNTINGS, 40-MM. A.A., MARKS 7 AND 8

and

## PLATFORM, FIRING, 40-MM. A.A. MOUNTING, MARK 1/L/INDIA

1. The above equipment is carried on a two-wheel transporter or platform designed for lightness and manœuvrability.

2. **Ordnance.**—The Mark 1\* is the standard gun, and is described in Section 1 of this manual.

3. **Mounting.**—The **Marks 7 and 8 mountings** are the **Marks 3 and 4** converted. The main change is the removal of the power-operated elevation and traversing gears and part of the frame, with the addition of a new type loading platform and footrests.

The parts removed are as follows :—

- (1) Oil motors—Elevation and Traverse.
- (2) Joystick control, slip ring, junction box, etc.
- (3) Low speed indicator.
- (4) Footrests, left and right and front firing pedal.
- (5) Loading platform.
- (6) Frame—front half removed.
- (7) Synchronizing gear complete.
- (8) Elevation trip switch gear.
- (9) Cartridge deflector centre channel, and chute supporting angle.

The parts added are as follows :—

- (1) Frame supporting footrests.
- (2) Footrests, left and right.
- (3) Loading platform.
- (4) Cartridge deflector centre channel and chute supporting angle.
- (5) Traversing stop.

4. **Platform.**—The firing platform is a square-shaped built-up structure, to the top of which the base ring is secured.

Immediately under each corner is a rectangular box, the centre line following the corner diagonals of the platform.

The platform is carried on a **Carriage, Transporting, 40-mm. equipment, Mark 2/1.**

When the platform is in position on the ground, four legs or girders are fitted to it, one being inserted in each of the rectangular boxes. The legs are "H" section girders, and on the outside ends the top flange is cut away. Welded to the outside end of each leg is a plate which rests upon the ground when the leg is in position. Through each plate a square hole is cut and a square socket is welded above the hole. A square sectional picket is inserted through each hole and driven into the ground. As the sockets and holes in the plate ends of the legs are inclined with their bottoms nearer to the centre than their tops, the tendency when the pegs or pickets are driven in is to make the platform as rigid as possible, by forcing each leg to the centre of the platform.

The gun, with its mounting and platform, is carried on a **Carriage, Transporting, 40-mm. equipment, Mark 2/1**, and is hauled up on to it or let down from it by blocks and tackles. At two of the corners of the platform and on the same side of the square an eye is welded to the rectangular box and to the platform section for this purpose.

5. The **Carriage, transporting**, consists of a built-up frame supported on a single pair of wheels. It is equipped with Lockheed brakes, which are operated from the towing vehicle by 10 ft. of cordage with a toggle end.

6. The **gun stay** is a fixture at the rear end of the carriage, being fixed vertically at right angles to the frame. Two eyes are attached to the side members; these are used in conjunction with the eyes on the platform for raising or lowering the mounting from or to the ground with the blocks and tackle.

7. The spare wheel is carried on the gun stay at its front and the four pickets for securing the legs of the platform to the ground are carried in a bracket at the rear.

8. The mounting is secured to the carriage by four clamps. The two rear ones are spring loaded and situated on top of the carriage; the two front ones are also on top of the carriage, but are operated by large wing screws from beneath.

9. Immediately in front of the front clamps are brackets with clamps and large wing screws for housing and securing the platform legs.

10. A spring-loaded towing eye is fitted to the carriage.

11. The **axletree** is the **No. 230 Special**, shortened by 6 ins.

12. The **wheel** used is the **wheel, pneumatic, No. 73, Mark 1**.

13. The **hub** used is the **Hub, wheel, anti-friction, detachable, No. 79, Mark 1**.

14. The **detachable wheel** is the **Wheel, detachable, No. 28, Mark 1**.

### APPENDIX 3

#### ORDNANCE, Q.F. 40-MM., MARK 1/2

on

#### MOUNTINGS, 40-MM. A.A., MARKS 9 AND 10

and

#### PLATFORM, 2-WHEELED, 40-MM. A.A., MARK 1

1. The design of the above platform is the result of developing an equipment convenient for transport by air, and at the same time having good mobility under conditions of jungle warfare.

2. **Ordnance.**—The **Mark 1/2** gun is the standard **Mark 1\*** gun fitted with a muzzle brake, and is described in Section 1 of this manual.

With the idea of enhancing steadiness of laying at automatic firing, the muzzle brake has been introduced to reduce trunnion pull. The equipment, however, operates satisfactorily without a muzzle brake. In addition, the buffer control rod is modified by removal of metal from the stem.

3. **Mountings.**—The **Marks 9 and 10** mountings are the **Marks 3 and 4** converted to suit the Platform, 2-wheeled, 40-mm. A.A., Mark 1.

All electrical gearing is removed and both mountings are hand operated. The frame, platform and seats have been removed and replaced by others of different design; in addition, shields are removed, and a front firing pedal is fitted.

A screwed traversing stop is incorporated to prevent any tendency of the mounting to swivel around whilst travelling. It secures the mounting to the platform.

4. **Platform.**—The Platform is two-wheeled, and every endeavour has been made to lighten the overall weight without upsetting the firing stability of the equipment.

(SO 1708)

H.

The three-girder or outrigger design has been evolved as the most favourable arrangement to achieve ease of levelling, compactness in draught and speed into and out of action, as well as to meet the overall objective of weight reduction.

The combination of two swinging girders and one sliding girder has resulted in a neat compact arrangement which conforms to space limitations imposed. In addition, the fact that none of the girders are separate from the platform, and so do not require any fitting or lifting, etc., on coming into or out of action, is a distinct advantage where speed of emplacing is necessary and during the hours of darkness.

The two swinging girders also act as the engine draught connector when the platform is being towed, the towing eye being attached to the right girder.

A screw jack, hand operated, is attached to the outside ends of three girders ; these are used to level the platform and to facilitate the removal of the wheels.

The wheels are attached to the platform base by means of a quick release pin and trunnion arrangement ; the female or platform portion is fitted with coil springs and pivoted to the platform, so providing independent springing for each wheel.

In the firing position, the two swinging or the right and left outriggers are swung outwards from the travelling position and locked by pins, whilst the sliding, tubular or rear outrigger is pulled out and locked in position by a screwed locking device ; the same locking device is used to lock the rear outrigger when in the travelling position.

The gun stay is fitted to the outside end of the rear outrigger immediately behind the screw jack.

The platform is equipped with Warner electric brakes, which are operated by the driver of the towing vehicle, but are independent of the towing vehicle brakes. The current is obtained from the towing vehicle and is connected to the platform through a plug on the end of the left outrigger. A hand operated controller to enable the driver to operate the brakes is fitted to the steering column pillars of the towing vehicle.

Faults, their causes and remedies dealing with the Warner brake are fully covered in the Maintenance Manual for the equipment.

## 5. Miscellaneous Data

### Complete equipment—

#### Draught position—

Length overall	...	...	...	...	15 ft. 8½ ins.
Width overall	...	...	...	...	4 ft. 10½ ins.
Height overall	...	...	...	...	5 ft. 10½ ins.
Weight	...	...	...	...	3,500 lb.
Wheel Track	...	...	...	...	49½ ins.
Ground clearance	...	...	...	...	11½ ins.
Height to Platform top face	...	...	...	...	19¼ ins.

#### Firing position—

Length overall—					
Platform	...	...	...	...	10 ft. 5¼ ins.
Equipment	...	...	...	...	13 ft. 2½ ins.
Width overall—					
Platform	...	...	...	...	11 ft. 9½ ins.
Equipment	...	...	...	...	11 ft. 9½ ins.

#### Tyres—

Tyres	...	...	...	...	26·00 × 8·50.
Pressure	...	...	...	...	40 lb. per sq. in.